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SCIENCE AND TECHNOLOGY

CHINA EXAMINES SCIENCE POLICY -- IV

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CONTENTS

'TEXT' OF FANG YI ADDRESS TO SCIENCE COUNCIL

OW062150 Beijing XINHUA Domestic Service in Chinese 1319 GMT 5 Jan 84

[Text] Beijing, 5 Jan (XINHUA)--Fang Yi, member of the Political Bureau of the CPC Central Committee, state councillor and minister in charge of the State Scientific and Technological Commission, spoke at the fifth session of the Scientific Council of the Chinese Academy of Sciences. The full text follows:

Council members, comrades: It is of great significance that you are holding this session at the beginning of a new year. On behalf of the CPC Central Committee and the State Council, I would like to extend my warm congratulations to you.

Thanks to the hard work of the people of the whole nation, the development of the nation's situation in 1983 was really inspiring. After conquering serious natural disaster, the national economy developed steadily. The political situation was more stable, public security was improved further and better results were achieved in building the socialist spiritual civilization. Particularly the industrial and agricultural output value quotas for 1985, as outlined in the Sixth 5-Year Plan, were prefulfilled 2 years ahead of schedule. This shows still further that the path of economic development we have taken in recent years is correct. The CPC Central Committee and the State Council are very grateful for the enormous contributions of the scientific and technological workers of the whole country to building a modernized socialist economy. The signal changes in the rural economy, the rapid development of a number of medium and small-sized cities and industrial enterprises and the new progress in modernizing national defense--all these achievements represent an embodiment of the painstaking work of the vast number of scientific and technological workers. You council members and other scientific and technological workers of the Chinese Academy of Sciences have accomplished a great deal of work to make our country's scientific and technological undertakings flourish, to promote economic construction and to propel the Chinese Academy of Sciences forward.

Since 1979, the Chinese Academy of Sciences has won 61 of the 642 national awards for inventions. In addition, the academy also participated in research in 21 projects that won national awards. The achievements of the Chinese Academy of Sciences' research work are multifaceted. Some the achievements are of great economic or scientific value. For instance, the academy successfully developed an electronic computer capable of 10 million calculations per second. It is China's first vector computer with its own special features in design and better reliability. The academy built a new long-wave time service station whose precision, improved from millisecond to microsecond, is up to the world advanced level. The academy built a proton linear accelerator with a capacity of

10 megavolts and a current of 50 to 70 milliampere. This achievement provided the material base for the development of experimental physics and wide application of accelerators. Industrial tests of the hybrid fuel of oil and coal have shown that this fuel can replace 30 to 40 percent of oil. We have achieved a major breakthrough in producing butadiene by oxidating and dehydrogenating butane, which will have great significance for our country's synthetic rubber industry. The renovation of Yanshan Petrochemical Company's heat pipeline network has provided the whole nation with experience in solving the problem of heat loss through dissipation. That experience, if widely popularized, will yield great economic results. The yeast alanine transfer ribonucleic acid synthesized for the first time indicates that our country's research on the macromolecule of synthetic organisms remains in the advanced ranks of the world. We have done a great deal of work in the wide application of systems engineering and applied mathematics. We have collected a wealth of information and achieved plentiful scientific achievements in conducting general surveys of the Qinghai-Xizang plateau, glaciers, frozen earth, deserts and salt lakes. Such information and achievements have great value for land reclamation and for building and maintaining benign environmental and ecological life cycle. The Chinese Academy of Sciences has also provided new equipment, apparatus and new materials for the modernization of national defense. The achievements of the Chinese Academy of Sciences in various fields all represent the vigorous support and close cooperation of many council members and relevant departments. All scientific and technological workers who make contributions to the four modernizations deserve the full respect of the people.

In fulfilling various tasks in creating a new situation in all fields of socialist modernization during 1984, we still need to take a firm grip of economic construction as the core, while all other tasks must subordinate themselves to and rally around that core. Under no circumstances should they interfere with and undermine that core. Doubtlessly, in doing our work in the field of science and technology, we must work hard to fulfill this central task.

The national conference on scientific and technical work ended just 2 weeks ago. Participating in the conference were leading cadres in charge of scientific and technical work in various departments and localities. Today your conference has just begun. Attending the conference is a representative sample of outstanding scientists in various scientific and technical fields throughout China. The two conferences have different approaches, but they share a common theme--that is to mobilize and organize the broad masses of scientific and technical workers to implement further the guiding ideology of making scientific and technical work serve economic construction, to quicken the pace for scientific and technical advancement, and to make new and great contributions to invigorating the economy and the Chinese Nation.

During the past few years, China's scientific and technical work has undergone strategic changes. On the basis of the situation in contemporary scientific and technical developments, Comrade Deng Xiaoping, in his speech delivered at the national science conference, emphatically pointed out that science and technology are productive forces. He fully reaffirmed the significant role of science and technology. In early 1981, the party Central Committee and the State Council lay down a new guideline for developing China's science and technology. At the 12th National Party Congress, Comrade Hu Yaobang pointed out that science and

technology constitute a strategic focal point in economic construction. At the national scientific and technical awards meeting held in October 1982, Comrade Zhao Ziyang once again issued a call: "We must rely on science and technology in promoting economic construction. Scientific and technical work must serve economic construction." Gratifying changes have taken place in China's scientific and technical work, thanks to correct guiding ideology, principles and policies. In order to promote China's economic development, the broad masses of scientific and technical personnel have worked hard, while closely linking scientific research with production. More and more cadres and masses have realized the important position and role of science and technology in promoting socialist modernization. To cherish, study and apply science is becoming a new social practice.

Naturally such a change has just begun. To turn guiding ideology into people's conscious general knowledge and transform principles and policies into people's initiative and actual deeds, we must work hard and perseveringly over a protracted period.

The Chinese Academy of Sciences is a comprehensive research center for science and technology in China. The Scientific Council has brought together outstanding experts in all fields throughout the nation. It has a great many outstanding scientific and technical personnel and fairly good conditions for doing research work. Under the new historical conditions, the party and people have fervent hopes for the academy. It is hoped that the Chinese Academy of Sciences will do more to help quadruple China's annual industrial and agricultural output value by the end of the century and play an even more significant role in invigorating the economy and realizing the modernization program.

In what way can the Chinese Academy of Sciences carry out its work to meet the needs of the era and satisfy the desires of the people? The party Central Committee and the State Council are extremely concerned over this question and have repeatedly expressed their views. Consultations and discussions have been held for a considerable period, and the opinions of many members of the Scientific Council have been solicited within the academy of sciences. Recently the Secretariat of the CPC Central Committee held discussions. It believed: In doing research work, the academy should implement its guiding ideology of serving economic construction. It should strengthen applied sciences research actively but selectively in doing development work and continue to pay attention to basic research.

On the basis of the views expressed during the discussions held by the Secretariat of the CPC Central Committee, I would like to voice the following expectations:

1. Raise one's awareness, and play a still better leading role in fulfilling the guiding ideology of making scientific and technical work serve economic construction.

The 12th National Party Congress has put forward the strategic targets in economic construction. Economic construction is the core of the entire socialist modernization program. Without pushing forward economic construction, it is useless to talk about other things. Without relying on science and technology, it is

impossible to achieve the goal of quadrupling China's annual industrial and agricultural output value. Therefore, to quicken the pace for scientific and technical advancement and help realize the strategic targets is a heavy historical task on the shoulders of China's scientific and technical personnel in the contemporary era. To orientate ourselves to serve economic construction should, doubtlessly be the guiding ideology of the work of the Chinese Academy of Sciences also. It is necessary for the Chinese Academy of Sciences to conduct research work in many academic fields and on a broad scale. However, the focus of the work of the academy and its main forces should be orientated to serve economic construction. Efforts must be made to encourage even more middle-aged and young scientific and technical personnel to engage in this type of research and development, and in popularizing scientific and technical achievements. Even for those scientific and technical personnel who are engaged in scientific research work for national defense or in basic research, we should encourage them to concern themselves over economy, understand the needs in economic construction and help them raise their awareness in serving economic construction. Imbued with this kind of concept, one will be able to consciously and in a timely manner notice the possible application of the results of the research work in economic construction.

This act of the Chinese Academy of Sciences itself will set a good example for others. At the same time, the various academic activities and research work jointly carried out between you and people in all fields will encourage and give impetus to the scientific and technical workers throughout the nation to do a still better job in serving economic construction.

2. Vigorously strengthen applied sciences research while keeping major scientific and technical problems in economic construction in one's mind; and actively, but selectively, engage in the work of development. There are always some scientific and technical problems that we need to study and solve in launching major construction projects for the development of our national economy, in promoting major technical transformation in traditional enterprises, in building and developing new industries, and in assimilating and inovating imported technologies. The Chinese Academy of Sciences should enthusiastically select the major key problems in economic construction and assume the task of organizing all departments concerned in the nation to tackle such key problems in a unified manner. It should bring into full play its superiority of being comprehensive in nature, coordinate cooperation among various academic disciplines in the academy, and help strengthen coordination among basic research, applied sciences research and development work.

In face of the rapid development of high technology in the contemporary world, the Chinese Academy of Sciences must bring its own potentials into full play and do a still better job in making use of its own fairly solid foundation. Special attention must be paid to studying and developing micro-electronics, information, handling biotechnology and new materials and putting its achievements into good use so as to precipitate a great leap in China's productive forces, stimulate the transformation in industrial and technological structure, and quickly put China's national economy on a new technological base.

In continuously tackling the key problems, the Chinese Academy of Sciences must show adequate division of work and foster close cooperation with various industrial departments, institutions of higher learning, scientific research departments for national defense, and local scientific research organs. They should not duplicate each other's work at the same level. Generally speaking, the applied sciences research and development work of the Chinese Academy of Sciences should be carried out more farsightedly, sooner, and more intensively. Attention must be paid to conducting research work systematically and understanding the law of development clearly. It is necessary to know the how and also the why so as to enhance China's own capabilities in bringing forth new ideas.

To place emphasis on tackling the major key problems in economic construction does not mean that we may ignore the research and development of other problems in science and technology. We should actively make arrangements to effectively tackle such problems also whenever it is possible to do so.

3. Continue to pay attention to basic research and give scope to the special role played by the Chinese Academy of Sciences in this regard.

Major technological advances in the days to come will depend more and more on breakthroughs in basic research. Because of this, some research results achieved by foreign countries will not be openly publicized as in the past. This trend makes it imperative for us to pay even more attention to those fields of basic research which will open new paths for technological developments. Work on basic research should not be weakened. Since the Chinese Academy of Sciences shoulders the major responsibility in this respect, we should continue to attach importance and give support to it.

The scope of basic research is extremely wide. We should give particular attention to strengthening the basic research in those fields which could have significant effects on the long-range development of our national economy, which focus on the characteristic national conditions of our country, and which are of vital importance in science. Continued support should be given to the research work of those scientists who are doing basic research on a long-term basis. As for the research work on "big science projects" requiring enormous human, material, and financial resources, because of our limited conditions, we can only be selective and carry out some according to our capabilities. The research projects of some scientists may draw varying comments, either favorable or otherwise, for the time being, but as long as they are working with a conscientious attitude, they should be given due support.

Basic research requires long-term efforts. Once appropriate research projects are determined and research personnel assigned, there should be no change unless absolutely necessary. This will enable the research personnel to do their work in a steady and sustained manner.

4. Serve as good advisors to offer suggestions on the state's major policy decisions.

The influence from a correct or incorrect policy decision often surpasses the effect that a certain scientific and technological project can bring about. Generally speaking, not only policy decisions in the field of science and technology but those on economic and social development require careful consideration of the related scientific and technological factors, and involve the application of various scientific and technological means and ways. The Party Central Committee and the State Council consistently attach importance to the role played by the Chinese Academy of Sciences in this respect. We hope that the academy will, on its own initiative, take an even more active part in making major policy decisions in the future. Members of the Scientific Council and the broad masses of scientific and technological workers should be given encouragement and support so that they will emancipate their minds and boldly air their views. In the meantime, we should make systematic and scientific analyses of some major policy decisions in an organized way and strive to probe new paths for our country's modernization program.

In view of the above, the Chinese Academy of Sciences should create conditions for members of its Scientific Council and the broad masses of scientific and technological workers to acquire a deep understanding of the current situation and needs of the economic and social development of our country. Besides, it should strive to cultivate a number of competent workers who not only have a rich knowledge of natural science and technology, but are also rather familiar with social science and our economic policy.

5. Enthusiastically popularize and apply scientific and technological research results in every way possible.

To speed up the transfer of research results to production, the state is taking steps to implement the principle of depending on science and technology in promoting economic construction and to stimulate the enthusiasm of enterprises to use new technologies. This is an established principle. Of course, numerous difficulties and obstacles still exist in this respect, and many concrete problems should be settled step-by-step with the readjustment of our economic policy and the reform of our economic system. What is important is that leading cadres at all levels and economic workers should heighten their consciousness about the principle that economic construction must depend on science and technology.

On the basis of the actual situation, the Chinese Academy of Sciences should still take the popularization and application of research results as one of their regular and important tasks. Transfer of technologies and research results to industrial and agricultural production units may be carried out in different ways. It may be the offer of research results obtained in laboratories. It may be assistance in conducting pilot-plant experiments. It may be direct supply of products and equipment or assistance to enterprises in setting up production lines. So it should not be the same for all cases. The dissemination of research accomplishments of the Chinese Academy of Sciences should also include the passing of new scientific ideas, experiment methods, experimental equipment, and basic research results on to other research, design, and education organizations.

While putting stress on the work popularization and application, we do not want every research worker to simultaneously take up the task of popularizing research results. What we mean is that the Chinese Academy of Sciences and its subordinate units, including various research institutes, factories, and publishing houses, should seriously grasp the work in this field.

6. Carry out various kinds of reform on a trial basis at localities selected for such experiments, conscientiously sum up the experience gained there, and make serious efforts to speed up the pace of reform.

The present organizational and management systems for science and technology must be reformed, otherwise they cannot suit the needs of the modernization program. The organizational and management systems of the Chinese Academy of Sciences, too, must be reformed by all means.

The reform of the Chinese Academy of Sciences should be carried out in such a way as to assist in giving full play to the scientific and technological personnel's initiative and creativity, stimulating the vigor and vitality of its various research institutes, and strengthening the ties between scientific research and production. For different types of research institutes and research work, different management methods should be adopted.

At present two rather striking questions are worthy of study. One is the mobility of research personnel. Only with the mobility of research personnel, is it possible to speed up the dissemination of knowledge and transfer of technologies. The Chinese Academy of Sciences should make positive efforts to recommend some outstanding personnel and backbone workers to work in other departments and localities where their service is more needed. At the same time, it should call on and encourage scientific and technological personnel to take up concurrent jobs of giving technical guidance and teaching in other units. In so doing, the Chinese Academy of Sciences will be able to recruit more outstanding young people. This is very important. The other question is the management of funds. Research isntitutes differ from factories in their nature and work. The economic results of a research institute cannot be assessed simply by the amount of its revenue. However, in order to really support the good ones, guard against waste, and obtain greater returns from the investment in scientific research, it is imperative to reform the present fund management system. In particular, experiments on reforming the fund-appropriation system for exploratory work on science and technology should be carried out. In this connection, various measures, such as the contract system and the fund system, may be adopted on a trial basis so as to gain experience and gradually popularize the most suitable one.

Now I will say something about the nature of the session of the Scientific Council in the Chinese Academy of Sciences. The title, member of the Scientific Council, is the highest academic title in our country. To give full play to the role of Scientific Council members in the academic field, we should let them do as little administrative work as possible. Most of the Scientific Council members are from units not within the academy, and they reside in different parts of the country. Each member has his important tasks. At ordinary times, these

members cannot deeply understand the state of work carried out by the Chinese Academy of Sciences. For this reason, it is difficult for the Scientific Council session to function as the highest policy decision organ of the Chinese Academy of Sciences. After acquiring opinions from various circles and through careful study, the Party Central Committee and the State Council believe it more appropriate for the Scientific Council session to function as an organ for academic assessment and consultation. The function of the Scientific Council session and the Presidium of the Chinese Academy of Sciences should be to organize the Scientific Council members to study our country's scientific and technological development and the questions concerning science and technology in our modernization program, to take an active part in formulating the state's major scientific and technological policy decisions and economic policy decisions, and to assess and guide major academic work carried out by the academy and its research institutes.

Members of the Scientific Council, comrades:

The Chinese Academy of Sciences is an institution with a galaxy of talented scientists and technicians. The most fundamental aspect in making the academy's operation a success is to implement earnestly the party's policies on intellectuals, continue to strengthen the unity among scientists and technicians, give full scope to their initiative and creativeness, guide them to pay attention to and study the trend of scientific and technological, economic and social development of the world today as well as our country's socialist modernization.

Recently, with the approval of the State Council, the State Scientific Technological Commission announced a 6-point policy, pointing out that the effort to combat spiritual pollution does not apply to natural sciences or technological work. This policy is significant for enhancing the social ethics of respect for knowledge and for encouraging scientists and technicians to probe and create. Mankind today has achieved many scientific and technological accomplishments, which we should earnestly study and master. In the natural world, there are still numerous unknown areas which require us to study and probe. We hope scientists and technicians will continue to study Marxism-Leninism-Mao Zedong Thought, and apply the Marxist stand, viewpoint, and method of guiding scientific and technological research. Different academic viewpoints should be discussed under the guidance of the policy of letting a hundred schools of thought contend. We must draw lessons from history. Within the area of natural sciences and technological work, by no means should we simplistically substitute scientific study and scientific conclusions with philosophic concepts, much less sticking a class label on anything.

Like party and government cadres, the issue of making the ranks of scientists and technicians younger in average age is highly urgent, or even more so in a certain sense. We certainly attach great importance to and respect scientists and technical experts of the older generation, and we will continue to give full scope to their role in the future. But in this age when science and technology are fast changing, scientists and technicians must be highly vigorous and creative in order to catch up with the times. We must place a large number of middle-age and young scientists and technicians at various important research posts and academic leading posts where their talents can be brought into full play. We hope members of the Scientific Council and scientists and technicians of the older generation will consider it one of their most important jobs to use new people and guide young people.

While meeting with the delegates attending the fourth congress of members of the Scientific Council over 2 years ago, Comrade Hu Yaobang exhorted those attending the session to "Work with a sense of being the masters of your own affairs," "Look for research projects in actual production work." The Chinese Academy of Sciences has made gratifying progress in this regard. The Party Central Committee and the State Council wholeheartedly wish you to continue to exert great efforts, go all-out to build a stronger country and scale the heights of science and technology in order to revitalize China's economy, and build a socialist society with distinctive Chinese characteristics.

CSO: 4008/122

QIAN XUESEN DISCUSSES SYSTEMS ENGINEERING

Beijing XITONG GONGCHENG LILUN YU SHIJIAN [SYSTEMS ENGINEERING--THEORY AND PRACTICE] in Chinese No 3, 1983 pp 1-3

[Talk by Qian Xuesen [6929 1331 2773]: "Two Suggestions for the Systems Engineering Society's Current Work"; delivered at the society's spring conference on 8 March]

[Text] On 3 March, Xu Guozhi [6079 0948 1807] wrote and asked me to present my views to the spring conference on how we should respond to the national reform program and improve the work of the Systems Engineering Society. Below I shall discuss two points.

1. The Establishment of Socialist State-ism and the Development of Social Science Methodology

As everyone knows, our first 5-year plan progressed very smoothly, with industry increasing at an average annual rate of 18 percent and agriculture at a rate of 4 percent. Subsequently, however, problems arose, and this speed was never attained again. One theory had it that since the base figures had increased, the annual rate of expansion was bound to decline. Since it was economists who made this assertion, I cannot but accept it. Nevertheless, the distinguished and brilliant economist Sun Yefang [1327 0396 2455] has destroyed this theory. How did he do it? He pointed out that the key lay in policy. For example, if we do not improve the scientific and technological bases of production and engage instead solely in development through extension and in copying old methods, large base figures will surely cause growth rates to decline. On the other hand, if we adopt new technology and emphasize intensive development, we may be able to maintain rapid growth.

I was recently reminded of the socialist principle of distribution which we formerly espoused: "From each according to his ability, to each according to his work." How, I wondered, are we ever going to get "each person to work to the best of his ability"? When this problem was discussed a while back, some people felt that that would not be easy, and some thought that we ought to stick to "distribution according to work" and forget the rest. I am afraid these views are wrong. The new party constitution retained the old slogan, but I would like to venture a bold (and probably erroneous) opinion: I think the elements in the slogan ought to be reversed to read "from each according

to his work, to each according to his ability." For when people are not paid according to their work, they will never be induced to do their best, as our society hopes they will. Who, among all the able-bodied in our 1 billion population, does not wish to do his best? But how is that to be achieved? There is currently some unemployment among youth, and a few people have bad attitudes, for which they are accused of being lazy or discourteous. Actually, we should not blame these people entirely, for they are dissatisfied. I heard a story about an old man who wanted to get off a bus, felt the passengers in front of him were moving too slowly and thus struck one of them with his cane. Naturally, he was criticized: "How can you go around hitting people?" But a youth at the scene offered a reasonable observation: "Many people are disgruntled these days, and I think the old man is one of them." In my view, their grudges are due to no other reason than suppressed spirit and dissatisfaction.

On 4 March, an article by Lin Jingyao [2651 0079 5069] entitled "Marxist Epistemology and Socialist Modern Development" appeared on page 5 of RENMIN RIBAO. Lin argued that the reason progress was so smooth prior to 1955 was that the policy then suited China's conditions. Later, however, we conceived an arbitrary model for China's agricultural development that proved inappropriate in practice. Since the 3d Plenum of the 11th CPPCC and under the leadership of the party, the masses have created a model based on actual conditions and suited to China's agricultural development, which thereafter has been very rapid.

What is science? It is rooted in objective reality. Things imaginary and divorced from reality do not constitute science. In "On Practice," Chairman Mao presented the following incisive analysis:

"Marxists recognize that in the absolute and general development of the universe, the development of each particular process is relative and that hence, in the endless flow of absolute truth, man's knowledge of a particular process at any given state represents merely a relative truth. The total of innumerable such truths constitutes absolute truth. The development of an objective process is full of contradictions and struggles, and so is that of the workings of human knowledge. All the dialectical movements of the objective world eventually come to be reflected in human knowledge. In social practice, genesis, evolution and extinction recur infinitely, and so also do these processes occur in human knowledge. As man's practice--which changes objective reality in accordance with given ideas, theories, plans or programs--advances ever further, his knowledge of objective reality likewise ever deepens. Change in the world of objective reality is infinite, and so is man's cognition of truth through practice. Marxism-Leninism has in no way exhausted truth but ceaselessly blazes new trails to the knowledge of truth through practice."

I was deeply inspired anew as I reread this. We must now encourage everyone bravely to reform all irrational systems impeding the masses' initiative, summarize the masses' experience, objectively and practically recognize China's realities and move on to establish scientific policies and

organizational structures suited to China. This project to transform and build China is one for systems engineering and social engineering (or social-systems engineering). This type of learning has yet to be established. To do so, we still need to construct an appropriate basic theory, which I have termed socialist state-ism. Basically, the socialist state has eight functions: production of material wealth, creation of spiritual wealth, the service industry, administrative management, the socialist legal system, international relations, defense and environmental control. I may have omitted something from these eight functions, for there are other aspects. Systems engineering must be established for each of these functions, the aggregate of which will form the social engineering I mentioned above. If these systems engineering approaches are established, the appropriate basic theory--socialist state-ism--will also emerge and be perfected. Then we can set scientific policy, and decision making will have a scientific basis. Everyone now realizes that in order to effect socialist modernization or the quadrupling of output by the year 2000, we must depend on advances in technology, just as comrades in the central leadership have emphasized: Rely on policy and science. I recently saw a report from Tianjin stating that every 1 yuan invested in scientific research increases output value by 22 yuan, of which the state receives 6 yuan in taxes. Now, is that not a good return on investment? Peasants now place great importance on scientific methods, calling technicians "gods of wealth." Vital interests have made peasants realize the power of technology and that the road to wealth lies therein. Yet I believe that we should not stress the natural sciences alone, for they yield returns of only 10 or several 10's to 1 of investment. Rather, only by successfully handling social science and by mobilizing the socialist initiative of all the people can we attain returns of 10,000 to 1. This is closely related to the social systems or social engineering to which I have just referred. If this engineering is handled properly, 1 yuan can be transformed into 10,000, and negative factors into positive. Then we can restore the annual growth rates in output value attained during the first 5-year plan.

In September 1980, I published an article in Shanghai's WENHUI BAO entitled "From Social Science to Social Technology." In that article, I called for the creation of a social science methodology, which I asserted was even more important than technology in the natural sciences. I would like to publicize that view again today and ask Secretary General Tian Fu [3944 1133], who is in attendance, to render vigorous support to the society's activities in this area. We must apply systems engineering to management at the state level and to socialist modernization. If this is done well, we can perform advisory work, provide some ideas for leadership cadres and thereby make a major contribution. Can we succeed? It is entirely possible in China. In capitalist countries, which now suffer from "economic recession," it would never work. They maintain systems of private ownership and free competition among capitalists, who lock minds and horns and cheat each other. How could those countries ever apply the science of state management.

If social science methodology and social engineering are applied, I believe our output will by no means merely quadruple but rise by leaps and bounds in 20 years. This is my first point.

2. Systems Science

At the society's spring conference last year, I explained the need to establish systems theory as a foundation for systems science. Today I should like to add a few more points. I believe that systems theory, which serves as the foundation for systems science, is very important. The problems we discuss invariably involve very complex systems. These systems, called megasystems, include many levels. One such level will have a particular form of motion; a higher level, a higher form. Thus the properties of each level also vary. Those properties that often appear at a higher level are not present at lower levels, and an even higher level will present still different properties. The existence of such levels is determined by objects themselves and is unavoidable. For example, are the macroscopic properties of a gas, such as temperature or entropy, possessed by individual gas molecules? Of course not. This point is crucial, for knowledge of things at a lower order does not enable one immediately to comprehend those things at a higher one. This represents true systems theory, which stands in opposition to reductionism. We can by no means embrace reductionism without systems theory, and of course we cannot have only systems theory without reductionism. Nevertheless, the time has come to stress systems theory. In the past, comrades studying complex systems often ignored this point and do not appear to have paid much attention to it in operations and control theory either. Both sociology and the natural sciences treat complex systems, or macrosystems. For example, Harkin's concepts of cooperation and community include complex systems and were adapted from laser theory. Wilson, who won the Nobel prize last year, posited the critical state theory, which also dealt with complex systems. He employed the renormalization group method to extrapolate from complex systems models an even higher scale of duration. This technique, however, must be applied very meticulously and involves extremely elaborate mathematical calculations. Wilson says his theory is applicable to the study of turbulence in the field of mechanics as well as to critical phenomena. In the work of constructing systems theory, I would like to recommend the "renormalization group" technique to everyone for consideration. I hope you will incorporate it into systems theory. At the society's spring conference last year, I discussed the theory of strange particles and noted that ordered systems can give way to disorder. I thus have introduced one theory a year in order to perform some "catalytic work." Yet what I really should like to do is to urge the society to organize its strength conscientiously and to begin serving socialist modernization. We must apply ourselves to practical work in this task and to the development of social engineering and socialist state-ism. At the same time, however, we must also undertake vigorous research in basic theory and science. While systems theory does not constitute the totality or the direct theoretical basis of systems engineering, it forms the crucial foundation of systems science. In order to get this work rolling, I should like to propose that the society organize a new committee (which we might call, for example, the systems science

committee) independent of the theory committee. Many people in the fields of biology and physics are active in this area. Several conferences have been held, including one on strange particles which was convened last year, but systems theory has yet to be incorporated. Is this not something we should undertake? Of course, theories in this field are very abstruse. Yet they are not divorced from, but rather guide, our practice. There is nothing to fear if we resolve ourselves to grapple with and master this work. With theory and our aspirations to undertake social and other types of systems engineering, we can link our work with the needs of socialist modernization and provide suggestions for many areas of state functions. In this fashion, the work of our Systems Engineering Society will make even greater achievements. And would that not be grand? These are the two points I wanted to make.

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ACCELERATION OF SCIENTIFIC, TECHNOLOGICAL DEVELOPMENT DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 9, 1983 pp 6-9

[Article by Li Zhongfan [2621 1813 0416], Zhou Yu [0719 1938] and Lu Guanglai [4151 0342 0171] of the State Restructuring of the Economic System Commission: "An Attempt at Discussing Several Problems Related to the Acceleration of China's Scientific and Technological Development"]

[Text] By the end of this century, China will effect socialist modernization, the national economy will show distinct growth and the people's standard of living will markedly improve. The key for all this lies in science and technology [S&T]. This means that we face the serious problem of how to accelerate S&T development. This is a complex problem that involves political, economic, cultural and educational aspects and that requires comprehensive and systematic study. For this reason, the authors propose to examine the following problems.

I. Establish "Letting S&T March at the Head as an Important National Policy"

In DAS CAPITAL, Marx made a brilliant exposition concerning the relationship of S&T to production: "Labor productive forces develop continuously with the steady advance of S&T." That is to say that increases in labor productive forces and economic development are determined by the development of S&T. This is because S&T are the crystallization of mankind's wisdom and knowledge and are condensed in the essential factors of productive forces. At the same time, while relying on the development of production, S&T rise above, and march at the head of, production, continuously opening up the path for raising and developing production. Every major S&T discovery and creation will have an important influence on the various aspects of social production and economy. History has proved that the development of S&T inevitably accompanies increases in social productive forces and economic prosperity. As early as some 60 years ago, after the proletariat had won political power for the first time, Lenin proposed, on the basis of fundamental Marxist principles, the following famous formula: communism equals soviet political power plus the electrification of the entire Soviet Union. He juxtaposed S&T and soviet political power and pointed out: "We cannot fill our stomachs by relying simply on destroying capitalism. We must acquire all culture that is left behind by capitalism and use it to build socialism.

We must acquire all science, technology, knowledge and fine arts. Without these, we cannot build a communist life." Lenin further told us clearly that "to build socialism, we must master S&T and let the broader masses apply them."

By the 1950's, the effect of S&T on the economy, military affairs and life-styles became increasingly prominent. For instance, generally speaking, one-fifth of the growth of labor productivity derived-from increases in investment, while four-fifths relied on technological progress and the rise in workers' skill levels. This effect and its steady growth indicate that S&T have entered a new stage. The French government maintains: "By giving priority to scientific research, we have chosen the road to overcoming crisis and strengthening the French economy." "The attention a country pays to its scientific research is a sign of the vitality of that society." "A country that has lost its scientific research is destined to decline." Japan has even made "using technology to build the country" national policy. Thus we can see that S&T have become important factors in building a country in the moden age.

All this explains why, if a society wants to achieve rapid economic development and to become a prosperous, rich and powerful nation, that society must let S&T march at the head. This is an objective law independent of man's will and proved by history and bears a special, important significance for our country, which seeks economic development. We must induce all members of society to attach great importance to this law and truly make it an important national policy in socialist modernization.

How should we weigh the extent of attention a country places on S&T? Generally speaking, we should adopt the method of systems analysis, in which we take S&T as a component of the larger science of social systems and assess S&T according to its input and output indices. The input index generally includes the ratio of personnel directly engaged in research relative to the entire population or the total number of workers, the ratio of research expenditures relative to the gross value of the national economy or the financial budget, and all kinds of information. The output index generally includes the quantity of S&T results disseminated or of patents registered, the quantity of new products and the quantity of scientific papers that are published. Facts have proved that, due to a dearth of statistical data, we still lack bases for using the abovementioned indices to carry out quantitative assessment of whether or not our country's S&T are marching at the head. But we have obtained some important insights through a cursory comparison of several of our known figures with those of the United States and Japan. Between 1965 and 1975, on average, for every 10,000 people, 25.4 to 24.8 people in the United States, 21.6 to 43.8 people in the Soviet Union and 9.7 to 16.7 people in West Germany directly participated in research. In 1975, the figure for Japan was 48.8 people, while in China there are currently only about 4 people so engaged. The ratio of research expenditures relative to the gross value of the national economy generally averaged 2 to 4 percent in the United States, England, France and Japan. Yet that ratio was less than 1 percent in our country. The gap in absolute research

expenditures was even greater. For instance, in 1977, such expenditures amounted to \$50 billion in the United States (private enterprise contributed \$20 billion of the total) but only 4.2 billion yuan (renminbi) in our country. What merits attention is that, due to all kinds of intricate factors, although we have attained definite results, output indices for China's research have not played any obvious role in directly promoting economic development. This is manifested in the rather slow increase in new products, the slow promotion of product quality and sluggishness in the application of new technology to production. In short, both the input and output indices for research demonstrate that the position and role of S&T in our country fall far short of meeting the needs of the four modernizations. We should, in light of the demands of national economic development, adopt effective measures to truly make "letting S&T march at the head" on important national policy in the four modernizations and accelerate the development of S&T.

II. To Make S&T Serve National Economic Construction, We Must Correctly Handle Proportional Relationships within S&T and Emphasize the Development of Technology

S&T are engendered through production. While the development of S&T stems in part from the workings of S&T's own contradictions, that development primarily stems from the needs of production and society. Thus whether or not S&T research is closely integrated with the needs of production and society becomes a decisive factor for S&T development. Proceeding from this premise, investigation at different levels of the appropriate proportional interrelationships within S&T research will facilitate creation of the benign cycle of production technology science.

From the perspective of the entire society, we must achieve an appropriate proportional relationship within and among basic theoretical research, social science research and natural science research. This is what is known as the major equilibrium. Basic theory refers to the common, nondirectional basic principles of social and natural sciences, which generally include astronomy, geology, biology, mathematics, physics, chemistry and philosophy. Natural science refers to the directional basic theories and technologies of natural science. Here, we must emphasize the explanation of this concept of social science, which primarily involves the study of man's thought, psychology and needs as well as human relationships and extends from these to such aspects as social structure. Social science no longer is merely a conceptual theory. With the development of S&T, we now possess the methodology to realize theory. For instance, the emergence of the modern science of management, econometrics, market forecasting and system analysis evidences the tremendous vitality of social-science methodology, which has become an indispensable component of S&T and plays an increasingly important role in the development of social production, of the economy and of S&T themselves.

Production departments must effect appropriate proportional relationships within and among advance, applied and developmental research. This is the

so-called intermediate equilibrium. Advance research refers to research in directional basic theory and nondirectional technological application. Applied research is research in directional technological application. Developmental research refers to research that transforms the results of advance and applied research into products and services.

Enterprises must realize appropriate proportional relationships within and among applied, design and manufacturing research. This is the so-called minor equilibrium, which is characterized by distinct directionality and direct service of enterprises' product development.

Technology manifests itself both in the form of production and in the form of science. Technology materializes the results of research and is a factor that promotes scientific development. Technology absorbs nutrients from scientific results in order to develop production and absorbs nutrients from production in order to develop science. Technology is a productive force that possesses boundless vitality and marches at the head of production. Thus industrially advanced nations commonly emphasize the development of technology to enhance productive forces and promote economic prosperity.

In our country, a developing nation, it is even more imperative that S&T directly serve production, the economy and defense. The determination of the abovementioned proportions undoubtedly should follow the road of developing technology. We should concentrate over 90 percent of all research manpower and material resources on the development of technology.

III. Vigorously Strengthen Research in Experimental Technology and the Building and Management of Experimental Methodology

The development of S&T is inseparable from that of experimental technology and methodology. Experimental technology and methodology are components of S&T and mark S&T development just as the production tools mark the development of the productive forces. The more S&T advance, the more closely related they become to their corresponding experimental technology and methodology. This has been proved by S&T advanced nations. We do not advocate departure from our country's developmental needs at the present stage, her S&T level and her financial strength in order to operate laboratory facilities and laboratories that require tremendous investment and that will not produce results for several decades or even a century. But our country's S&T development indeed faces the serious problem of having to strengthen the building and management of experimental technology and methodology. There are two common situations. (1) "Heroes" cannot "display their abilities." Many personnel are directly engaged in research work in many research units. But, due to the lack, of appropriate, or backwardness of our, experimental methodology, it is difficult to advance research work. (2) There are no "heroes" to "display their abilities." Some units fully possess experimental methodology, the level of which is relatively advanced but whose rate of utilization is very low. Laboratory facilities, which were built with the limited funds invested in research, have not been fully utilized. The basic reasons that have brought about these two situations are malpractices in

the state economic management system, noncompensatory investment in research and the failure to pay attention to economic results. These problems can only be solved through reform of the economic management system and through implementation of the strategic idea of "letting S&T march at the head." However, we should impress upon the parties concerned the importance of strengthening of experimental technology and methodology so as to meet the needs of S&T and especially emphasize developing technology.

IV. Reform the Research Management System and Give Full Play to the Dynamic Role of Research

Research management has already become a very important issue in S&T development. A system of management that suits the characteristics of S&T can bring about initiative in research and stimulate prosperous development in S&T. Conversely, management can become an unfavorable factor that delays and obstructs the development of S&T.

What are the shortcomings of our present system of research management? Briefly, there are three prominent problems. First, research is not closely related to production. In reality, research and production are "two separate matters." As a result, on the one hand, many major problems in production and economic construction have been omitted from research units' plans and thus ignored. On the other hand, many research results have not and cannot be popularized. Second, research units lack independence, "eating from the same big pot" is a serious problem in distribution, we thus have not been able to bring into proper play the initiative and creativity of S&T personnel and many laboratory facilities lie idle. Third, noncompensatory investment in research ignores economic results and economic responsibility, and thus research becomes a "soft target." The above conditions have given birth to a series of problems: disharmony between research and production, the difficulty in guaranteeing material conditions, the long cycle of research and manufacture and the difficulty in popularizing results, these problems have seriously affected the development of S&T. Reform of the system of research management has become an extremely urgent task.

In light of the characteristics of research and the reality of our country, we should attach importance to the following principles in our reform of the system of research management.

1. Clearly stipulate that of S&T management is part of national economic management and a component of the national economic system.

2. Fully mobilize and arouse the enthusiasm of research personnel and units, and encourage them to advance and blaze new trails continuously. All S&T management should implement the principle of competition.

3. Strengthen unified leadership and implement classified management. The former refers to the fact that the state should elevate research to an important position, stipulate various policies, plans and measures for pomoting S&T development and set the overall division of labor in the various fields

of research, so as to enable research to advance along the correct path. Classified management refers to the implementation of a centralized mode of management for major research projects that are related to the national economy and the people's livelihood. For instance, the state will be directly in charge of energy, space and defense projects and will organize the forces of research units, universities and enterprises to make coordinated assaults on key problems. As for general research on applied technology and research and development of new products, the decentralized mode of management will be implemented. Greater independence will be given to departments and enterprises, so that their management personnel will truly recognize the fact that technological development is related to their own success and will therefore consciously employ the proper amount of manpower and material resources. As for nondirectional basic theoretical research, a relaxed form of management can be implemented. In this way, we will be able to mobilize and organize the enthusiasm of all fields.

4. Integrate production and research, link research more closely with production and link planning for the development of the national economy more closely with that of S&T.

5. Expand the independence of research units and implement the technological-economic system of responsibility so as to give research units an intrinsic impetus. With the exception of basic-theory research units, the other units should all gradually implement the principle of economic management.

6. Implement dynamic management of research personnel, adopt all means to encourage and support that personnel's initiative and creativity in S&T work and carry out personnel exchange in a planned manner in order to prevent "inbreeding." At the same time, select outstanding young people to take turns shouldering leadership responsibilities at various levels in research organs and make such transfers at regular intervals.

V. The State Should Implement Centralized Management in Major Research Projects That are Related to the National Economy and the People's Livelihood, and Organize the Forces of Every Field To Make Coordinated Assaults on Key Problems

Facts have proved that it is now commonplace for the state to implement centralized management in major research projects that are related to the national economy and the people's livelihood and to organize the forces of every field to make coordinated assaults on key problems. This trend accords with the characteristics of modern research and the reality of our country and plays an important role in breaking down "closed, self-perpetuating systems" in our country's current research system; in integrating S&T forces into a unified core force that has tremendous vitality and that can surmount the "S&T fortress" in a coordinated effort; and in enhancing the development of the national economy.

Generally speaking, in implementing centralized management in major research projects, we should effect seven unifications: unified leadership in

academics, unified arrangement in planning, unified utilization of key facilities, unified exchange of information, unified handling of results, unified management of external affairs, and unified setup of major organs. Through the "seven unifications," we will form several mutually related research centers throughout the country, which centers will become the bases for organizing and implementing "coordinated assaults on key S&T problems." The implementation of centralized management does not imply that we are resorting to purely administrative measures, that we will entangle and confine relevant forces and that we will ignore economic results. Rather, we shall adopt economic methods that suit the characteristics of S&T and organize in a broader manner the forces of all fields in order to attain more effective results.

VI. Persevere in Materialist Dialectics, Uphold the Principle of "Letting a Hundred Schools of Thought Contend" and Make Our Country's S&T Work Thrive

The entire natural world moves in cycles, spiraling upward in a state of continuous movement and change. Thus mankind's knowledge and transformation of the natural world are only relative and develop and change infinitely. Facts prove that S&T develop infinitely, which is entirely in accord with the law of materialist dialectics. Thus man must consciously master materialist dialectics, maintain clear thinking and thereby greatly shorten the process overcoming the obstacles to S&T development. At the same time, society must consciously create the external preconditions for S&T development, conscientiously implement the principle of "letting a hundred schools of thought contend" and guarantee free academic exploration, so as to avoid unnecessary twists, turns and losses and to enable S&T to advance smoothly. These two points are interrelated and interactive. As long as we actively persevere in materialist dialectics, adopt practical and realistic measures, and unswervingly implement the principle of "letting a hundred schools of thought contend," we will definitely bring about a more radiant and beautiful "spring of science."

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SCIENTIFIC, TECHNOLOGICAL PLANNING WORK DISCUSSED

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[Article by Gan Zeguang [3927 3419 1639] of the Shaanxi Provincial Scientific and Technology Commission: "A Strategic Issue in Scientific and Technological Planning"]

[Text] In accordance with the state plan, the whole country is now drawing up a 15-year (1986 to 2000) program for scientific and technological [S&T] development. This is a major measure for realizing the strategic goal of economic development in our country. The central authorities have specially stressed that, when drawing up this long-term program, we must integrate S&T with the economy and society and provide for the coordinated development of all three. This has become a historical trend in modern social development and is a strategic issue in long-term S&T planning.

Planning work involves many theoretical and practical issues. In-depth study of these issues, the strategic question in particular, will have an important bearing on and prove decisive to "doing a good job of drawing up a program for promoting the four modernizations."

For a long time, we have not been sufficiently scientific in our planning work and indeed have some shortcomings, such as:

1. "The system of departmentalism." Industry, communications, agriculture, finance, commerce, trade, science, education, culture, construction, environment, and health and sanitation all have their own systems and bailiwicks. Each competes for "positions," haggles over "prices," "strives to be first and fears to lag behind" and thus insists on attending to every detail in planning, lacking clear goals and focuses.

2. "The hors d'oeuvres method." From top to bottom there is mechanical duplication, which is done in the name of comprehensiveness and balance but in fact involves only the adding and subtracting of figures. There is no natural connection or organic unity among the subsystems that are the targets of planning work.

3. "Three separate matters." Economic, S&T and social development programs are separate from one another and lack overall design and unified planning.

4. "The absence of proportion." No definite proportions have been established for S&T education investment relative to gross national investment. Therefore, it is difficult to achieve planned and proportionate development.

5. "The two are divorced from each other." Long-term and short-term planning are divorced from each other. When it is unrealistic, the long-term plan cannot provide strategic guidance for the annual plan. When the latter lacks comprehensiveness, it naturally cannot implement the strategic ideas and goals of the long-term plan. Thus we work in an ad hoc fashion, responding to problems only as they arise; planning does not perform its developmental role.

6. "Emptiness versus emptiness." The S&T development plan consists merely of research projects and does not provide for comprehensive and planned S&T development. Thus the lack of support structures makes it difficult to effect the developmental undertakings of the S&T program. Some people call this "building castles in the air."

There is no lack of examples of these problems. It is easy to see that the most fundamental shortcomings are the failure at all levels of planning to provide for coordinated development of S&T, the economy and society and the lack of strategic research in formulating long-term plans.

In the interest of furthering discussion, I would like to express my opinions on the question of how S&T planning can achieve coordinated development among S&T, the economy and society.

I. "Three-in-One Combination"

In the reform of the system of planning, the general trend is toward building a three-in-one system involving society, the economy and S&T. Planning departments should assume unified and complete control of all planning work. We must shun "the hors d'oeuvres method among departments." State planning departments should assume general leadership over three-in-one comprehensive planning, in which work S&T departments and departments for social undertakings should actively cooperate. We must avoid "letting the secondary supersede the primary." Practice has proved that the three-in-one system of planning is the key link in the coordinated development of our country's S&T, economy and society and provides direction for the reform of our country's system of planning. We should stress and study the three-in-one system, regard it as a major social reform and put it into effect.

To this end, we must implement the "five integrations": the integration of decision-making and planning strata, of natural science and social science workers and of theoretical and practical workers, and, in particular, full cooperation between S&T, planning and economic departments, so that there will be mutual exchange and interplay among programs in these three areas.

II. "The Socialization of S&T"

In the present age, the rapid development of S&T has simultaneously accelerated both the process of making society scientific and the socialization of S&T. Thus S&T departments must serve as an advisory staff and a brain trust for the state's long-term planning work. As a component of "three-in-one" planning, S&T planning must first of all make social and economic development its starting and end points. Specifically, the 15-year S&T program should give priority to the revitalization of China through a quadrupling of output. In short, when we undertake S&T planning, we must serve society and the economy. This not only is the source of prosperity for S&T work but is also a key link in the realization of the "three-in-one combination." Thus the support structure (which includes manpower, financial and material resources, information and related policy) for developing S&T must have an effective social guarantee. This is the nexus of and basis for the integration of society, the economy and S&T.

With regard to the socialization of S&T, we fully agree with the policy of stressing the technological transformation of existing enterprises and with current long-term and short-term research plans. We should first of all emphasize a large number of projects that require little investment, have short cycles and produce fast results. But from the perspective of long-term planning, if we want to popularize within 15 years the technology that was considered advanced in developed countries during the 1970's and the early 1980's and to realize the "economic miracle" achieved by some countries after the war, then we should also emphasize many new or priority areas that are long term, comprehensive and pioneering and that bear a strategic significance for the development of the national economy and all S&T. Only in this way can our S&T work prosper and have long-lasting influence. Otherwise, the socialization of science will be like "water without a source or a tree without roots."

III. "The Creation of a Mathematical Model"

Modern society is a large system that is extremely intricate and that has many related factors. We can no longer draw up future blueprints by relying solely on our cognitive understanding and simple estimation. Thus we should utilize such modern tools as systems engineering, econometrics, economics, scientiology and forecasting, as well as such scientific methods as linear planning, decision-making technology and mathematical statistics to probe the internal interrelationships and laws of development among the various subsystems of society, economy, and S&T. In addition, by relying on computer technology, we can arrange and quantify this data, establish mathematical models and provide planning work with scientific bases through quantitative analysis and modern scientific methods. Generally speaking, there is more than one type of mathematical model for this type of planning, so we can select the best ones.

IV. "Standardization of Policies"

Planning is a type of "soft science" research. For many years, we have ignored the power of software and research on technological policies and thus have been unable to avoid mistakes in policy decisions. For instance, in industrial development, we stressed "heavy industry one moment and light industry the next." In our general development policy, we inclined "toward the left one moment and right the next." In petroleum development, we moved "toward the east one moment and toward the west the next." In coal excavation, we moved "toward the south one moment and the north the next." In chemical fertilizer production, we went for "large-scale production one moment and small-scale production the next," and so on and so forth. Because we did not have a clear orientation and goal, our technological policies fluctuated, our long-term and short-term plans thus lacked direction and we naturally suffered tremendous losses. Thus, in drawing up the state's long-term program, which will include the S&T program, we should concentrate on strengthening research in planning-software that takes into account technological policies, so that our general policies can promote coordinated development among S&T, the economy and society. This is another link that will facilitate the "three-in-one combination" in planning.

V. "Development in a Proportionate Manner"

It is an objective law that all things develop in a proportionate and coordinated manner. The correct handling of the proportional relationship among all factors related to the targets of planning is another key link in achieving the three-in-one combination of S&T, the economy and society. For instance:

1. "The S&T Investment Ratio"

The experience of the various countries in the world proves that investment in S&T is a strategic investment that yields returns of 10,000-fold. Premier Zhao Ziyang pointed out that, if output is to quadruple, one-half of that growth must come from advances in S&T. However, to date, less than one percent of our gross national product has been devoted to research. This ratio falls far short of that of advanced countries, which is generally two to five percent. In addition, our annual research expenditures are like a thermometer: they rise and fall suddenly. Because investment is out of proportion, S&T cannot improve, and economic and social development inevitably will be limited. Thus one of the important tasks of S&T planning work is to set, in light of national conditions and capabilities, the S&T investment ratio that best promotes the coordinated development of S&T, the economy and society.

2. "The S&T Mix"

In drawing up the S&T program, we must seek the proper mix of basic, applied developmental research.

At present, the ratio between basic, applied and developmental research in developed countries is generally 1:2-3:6-7, respectively. We should proceed from reality and set a rational mix that is suited to conditions in our country. Despite the fact that this mix fluctuates, it is directly related to the scientific character and effectivenss of our planning work.

3. "The Intellectual Investment Ratio"

In developing the economy, the key lies in S&T and the basis lies in education. Education has a "potential scientific capacity" and represents a strategic intellectual investment. Without a doubt, education is the foundation stone of the "three-in-one combination." If education does not progress, then the four modernizations will come to nothing. Our country's intellectual investment ratio is low and even lags behind some developing nations. In our S&T planning, we must clearly set a scientific intellectual investment ratio.

4. "The Intellectual Mix"

The intellectual structure and its internal proportional relationships is studied in order to give full play to the dynamic role of society's intelligence. This mix is directly related to the coordinated development of S&T, the economy and society. For instance:

(1) "The Knowledge Mix"

In foreign countries, the ratio of personnel with high, middle and low levels of knowledge is generally 1:2:4 or 1:3:9, respectively. Practice proves that it is more rational for the knowledge mix structure to take on the shape of a triangle. However, the present knowledge mix in our country is out of proportion and in serious disharmony. Of course, this mix varies according to country, field of study and developmental stage and is in a state continuous flux. Thus, in determining this mix, we should abide by dialectics and carry out concrete analysis on specific problems.

(2) "The Specialization Mix"

In a system that is a target of planning, there must be a rational proportion of specialized personnel. The specialization mix warrants study at all levels: from the entire productive sector, to the unit and even down to the individual.

(3) "The Age Structure"

Because their ages vary, people's intelligence, special skills and functional abilities also differ. Generally speaking, an ideal age structure should take into consideration the nature and needs of a society, an enterprise or a unit and design appropriate ratios for older, middle-aged and young people, so that we can make the best possible use of different people according to their intellectual levels and psychological characteristics. This forms the substance of studies of professional planning.

(4) "The Intellectual Ability Mix"

The intellectual abilities, that is, the ability to apply knowledge, among people who work in the planning system also differ in thousands of ways. Only by putting together a rational mix of intellectual abilities can we put these abilities to effective use.

(5) "The Leadership Structure"

The leadership structure is the intellectual structure at the decision-making level and is the key to the growth and prosperity of our work. Thus modern leadership should be a comprehensive body that includes a rational proportion of people of different professions, intellectual ability, ages, experience and qualities. This not only is a new topic for high-level leadership personnel departments, but is also a subject of study in planning work.

VI. "The Legalization of Planning"

There is no denying the fact that our country's legislative system is not perfect. Our long-term and short-term plans lack legality and authority. As a result, we issue orders in the morning and revise them in the evening, and thus our work lacks stability. This is a major drawback that prevents our plans from truly being fulfilled.

If we wish to provide effective plans that integrate S&T, the economy and society, we must formulate a complete "planning law" for our country and use that law to guarantee the legal effectiveness of our plans. Once enacted by legislative organs, our plans will become law, by which S&T, economic and social work departments must abide. In short, the study of planning law has become an urgent task.

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PLANNING FOR SCIENCE AND TECHNOLOGY DEVELOPMENT DESCRIBED

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[Article by Luo Wei [5012 0251] of the Policy Research Office, Chinese Academy of Sciences: "China's Planning for Science and Technology Development"]

[Text] In the development of China's science and technology [S&T], planning has played an important role. There have always been different opinions about the merits and drawbacks of centralized planning, and some people are also worried that planning may interfere with free thinking in science. This paper explores the practice and results of China's S&T development programs. Planning is also the concentrated embodiment of a series of goal choices, and through planning one may study the policy-making process for major research and development projects.

The Three Long-Term S&T Development Plans

China has made three long-term national development plans in S&T: the 1956-1967 program planned in 1956, the 1963-1972 program planned in 1963 and the 1978-1985 program planned in 1978.

In late 1955, China had basically completed its first 5-year plan for the national economy, began deliberating the second and third 5-year and formulated the 12-year agricultural development program. Since economic development depends on progress in S&T, the party and the government proposed undertaking long-term S&T development planning. At the Second Session of the Second National CPPCC, Premier Zhou Enlai pointed out that "the starting point of long-term planning is to introduce, according to need and feasibility, the most advanced science in the world to China as rapidly as possible to build up the weakest and most needed areas of science in China and, by planning our scientific research according to existing achievements in world science, to strive to reach the international advanced level of science in areas most urgently needed in China by the end of the third 5-year plan."

The 1955 plan was overseen personally by the premier and conducted under the direct leadership of the 3 vice premiers and a 10-member leadership group of the State Council (later organized into the State Countil S&T Planning Committee). After 6 months and extensive discussion with several hundred scientists, the following were promulgated: "The 1956-1967 S&T Development Program," "Explanations of Important National Tasks and Central Problems in S&T," "Explanations of Discipline Planning in Basic Science," and "Urgent Measures for 1956 and Essentials of the Research Plan for 1957." These documents consisted of about 6 million words and touched upon 13 areas, 57 programs and 616 central problems.

The 1955 plan contained the following features:

1. The plan was closely tied to the needs of national development. These needs included the identification of important and urgent scientific disciplines that were nonexistent or weak in China and that had to be established first, major problems of key importance and of an integrated nature in economic construction and scientific research and important technical problems in production and capital construction that had to be solved then or in the near future. In order to assess China's resources for systematic future development, the first 10 of the 57 programs proposed were surveys and investigations of China's natural conditions and resources.

2. The plan made important arrangements for the development of new technologies. In particular, the plan took urgent measures to establish and strengthen new technologies that were emerging on the international scene and that had far-reaching effects on all fields. These technologies included semiconductors, computers, electronics, automation, atomic energy and jet propulsion.

3. The plan gave proper attention to basic science and basic research. In addition to "research of fundamental theoretical problems in modern natural sciences," one of the 57 programs, development programs were also devised specifically for basic sciences.

4. The plan not only proposed tasks and topics, it also made general provisions for the national scientific research system, guidelines for using available personnel, cadre training and assignment distribution, principles for establishing scientific research institutes and international cooperation plans. More specific actions were proposed for a member of important and urgent tasks.

After the planning was completed, the State Council decided to make the S&T Planning Committee a permanent government organization (which later became the present State S&T Commission) in order to facilitate yearly execution of the plan; cooperation of scientific research in various areas; distribution, management and utilization of research funds; assurance of working conditions; training and deployment of technical personnel; and international cooperation and exchange.

As the result of a joint effort by all S&T personnel and cadres, the program basically completed its major aspects in 1961, 5 years ahead of schedule.

A scientific work conference was held in Guangzhou in March of 1962 to plan for S&T development programs for 1963-1972. In collaboration with the Ministry of Education, the Chinese Academy of Sciences organized scientists and formulated a 10-year, long-term development program in basic sciences, the various production departments formulated specialty programs based on their own missions and finally the State S&T Commission formulated priority programs. Then plans were set for a number of disciplines in technological sciences.

This planning work took 5 months and involved 900 scientists. The basic science program included 7 disciplines, 41 priority topics and 380 central problems. The technological science program included 13 disciplines, 32 priority topics and 145 central problems. Specialty programs included 39 areas and 301 priority topics. Altogether, there were 374 priority topics.

The 1963-1972 plan had a strong emphasis on agriculture. This was the result of greater recognition of the importance of agricultural development after 3 years of natural disasters. 111, or more than one-third, of the priority topics in the specialty program involved agriculture, forestry, water conservancy, agricultural mechanizations, desert transformation and tropical crops; and 7 of the basic science projects involved general improvement of agricultural technology.

Another unique feature of the 1963-1972 plan was the attention given to technological sciences and the initiation of special planning in the development of technical science. This was prompted by the urgent needs that resulted from advances in production and improvements in technical levels.

Since the "Cultural Revolution" began soon after 1963, the 1963-1972 plan was not carried out. But the prosperity of Chinese S&T in 1964 and 1965 had something to do with the planning of 1963.

After the downfall of the "gang of four," the party and the government, while trying to weed out the bad results caused by the depredation of the "gang of four," made important strategic deployments in S&T development and the four modernizations. Beginning in June 1977, departments of the State Council, localities and units did much work in devising S&T development programs. A national planning meeting for natural sciences was held in September and October and a national S&T planning meeting was held at the end of that year. After repeated discussion and modification, the "1978-1985 National S&T Development Program" (draft) was finally formulated. This program made general arrangements for research in basic science, technical science and 27 areas, including natural resources, agriculture, industry, defense, communications and transportation, oceanography, environmental protection, medicine, finance and education. From these fields, 108 projects were chosen as high priority projects. In this plan, eight comprehensive S&T areas of far-reaching influence--agriculture, energy, material, computers, lasers, space, high energy physics and genetic engineering--were given particular prominence, and efforts were concentrated to achieve results in these eight areas in order to promote the development of all S&T and the entire national economy. But because of inadequate assessment of the damages caused by the "gang of four" and an overly optimistic estimate of the economy, the 1978 plan demanded too much too soon and had an excessive number of large construction projects. In the past two years, the plan has undergone continual readjustment according to actual conditions. But the fact that the party and the government quickly turned to S&T at a time of numerous problems and destruction shows their determination to achieve the four modernizations. Furthermore, the development direction and the priorities determined in 1977 appear on the whole to have been correct, and they served to unify the effort of all S&T personnel in China.

Long-Term and Short-Term Plans

In terms of national planning, there are long-term (10 years or longer) programs, intermediate (5 years) programs and yearly programs. By combining the three types of programs, we have a clear, long-term direction as well as a staged plan of action and a guarantee of supplies of necessary material.

In terms of content, long-term planning includes S&T tasks, central problems and their significance, content and objectives; analysis of domestic and international development; approaches to solving problems; organizational measures; international cooperation projects; responsible units; and short-term research topics. Organizational measures include research institutes to be established, S&T staff to be assigned and requirements regarding the training of students in universities. Short-term plans also specify capital construction investments and the distribution of research funds. For example, in 1956 the emergency measures of a number of S&T tasks included the research organizations to be established immediately, assignment during the summer of graduates of institutes of higher education, training classes to be held immediately, urgent readjustments of college curricula, urgently needed international cooperation projects and other problems that had to be solved right away.

In terms of level, there are long- and short-term plans at various levels and in various departments. Generally, departments and local areas first propose preliminary program ideas to serve as the basis for the national long-term plan. Leaders of the responsible departments then get together with experts in various fields to draft a national program that synthesizes the needs of national development, international trends and preliminary proposals by the various departments and local areas. This draft is submitted for government approval. Planning departments then consider the overall balance of capital construction, funds, personnel and material. Once the national program is formulated, departments and local areas use it as a basis for forming their own plans. If a department or a locality is assigned to undertake or to participate in a project in the national plan, that project must be given top priority, and every effort must be made to strive for its completion. In addition to national programs, a unit has its own priority and general projects.

The advantages of such a planning system are: (1) S&T efforts of local areas and departments are unified under a single national goal, and cooperation and coordination are strengthened. (2) The distribution of manpower, material and money is made from a national consideration to support the most important area in an overall arrangement. (3) The system facilitates the matching of short- and long-term programs so that long-term development and meaningful work will not be neglected due to emphasis on the resolution of numerous immediate, practical problems and so that urgent problems are not overlooked in favor of long-term needs. (4) Since the process is repeated several times from

top down and from bottom up, communication between the whole and its parts is facilitated. Since the national plan begins by incorporating the opinions of the various departments and local areas, fund allocation is decided after repeated consultation and adjustment in terms of needs and availability and is not an external imposition. Meanwhile, the boundaries between departments and localities are overcome.

The situation changes as S&T continue to develop. For example, when the 1956-1967 plan was made, China's main research force was in the Chinese Academy of Sciences. Local research was very weak, many local areas and industrial departments still had no research organizations and, among universities, the major research efforts were concentrated in a few famous institutions. Planning was relatively simple at that time; yet even so, the substance of that planning was too diffused for across-the-board coordination and monitoring. Today relatively strong research forces have been formed in production departments, defense departments, universities, the Chinese Academy of Sciences and various provinces and municipalities. From the state's point of view, the plan should not be overextended; instead, the plan should concentrate on some key, strategically important projects of a comprehensive and pioneering nature.

The combination of research plans and business plans (including capital construction, finance, organization and personnel) provides a reliable basis for planning work and insures the availability of the necessary material. But this is still not enough; social and economic development plans should first consider the needs of social and economic development. Next the scope and speed of S&T development should be constrained by social and economic conditions (for example, S&T receive more financial support when the economy is good, less when the economy is bad). Third, proper arrangements should be made in economic planning so that research results may be turned into products to promote socioeconomic development. Adopting new technologies, investing in new products and funding technological improvements belong to this category. Effective and versatile coordination in this area is still far from enough.

Planning is the decision-making process for a series of problems, but it is not just policy making. Planning should also include the necessary action for achieving these decisions. But planning cannot include all of S&T development, and yet it requires guarantees from and the support of a series of policies, systems and regulations. For example, planning can only solve part of the problems of repetition and dispersion in scientific research, for which resolution we must rely mainly on the evaluation system and other means. Wastes and underutilization of equipment also require other solutions. Blaming planning for all flaws and imperfections is neither fair nor helps to pinpoint the causes of problems.

Task and Disciplines

Proper handling of the relationship between tasks and disciplines has always been an important problem in the formulation of plans. Some people believe that planning should be made on the basis of disciplines, but the disadvantage here is that such planning will not be sufficiently integrated with the needs of national construction and may not receive the support and understanding of society. Moreover, since most scientists do not have a systematic understanding of the state's technological needs, the weakness of this approach becomes even more evident. Other people believe planning should be formulated according to tasks, but the disadvantage of this approach is that the direction of S&T development becomes obscured and that coordination of tasks and personnel training is difficult because scientific cadres are deployed basically according to disciplines. Some scientists in particular are concerned that overemphasis on completing tasks may adversely affect systematic accumulation among scientific disciplines. Weighing the pros and cons of the two approaches, we believe that, on the whole, planning should be conducted for the tasks raised for S&T by national development but that in the meantime plans should also be formulated by discipline for both basic sciences and technical sciences. In other words, the approach should be mostly task-oriented but supplemented by discipline-oriented planning. Relevant research topics on fundamental theoretical problems may arise from task-oriented projects, while at the same time topics needed in national development may also be considered in discipline-oriented projects. In the program planned in 1963, for example, 70 percent of the topics in basic science had well-defined goals that served the needs of national development, while 30 percent of these topics were discipline-oriented, theoretical and exploratory; in the area of technical sciences, 90 percent of the projects were the first kind.

The relationship between task and discipline cannot always be treated in a perfectly satisfactory manner, but evidence shows that this relationship can be handled somewhat better than it is now. As is well known, the development of nuclear energy technology in China is based in the Institute of Modern Physics of the Chinese Academy of Sciences. Shortly after the revolution, the institute recruited a small number of scientists who were at the time authorities in nuclear physics. Although this foundation was not very strong, it was nonetheless indispensable. The fact that research institutes of the Chinese Academy of Sciences were able to produce China's first transistor, integrated circuit, computer and laser is precisely because the academy accumulated scientific knowledge and possessed a group of solidly trained scientists. This shows that scientific development provides relatively fast solutions to new needs in S&T. Projects in national construction often serve to train personnel and to promote scientific development. In the area of soil science, the Chinese Academy of Sciences initially only had a soil survey team; a number of specialties were gradually established later. If one pays attention, one can find many applications in scientific development. For example, the study of proteins and nucleic acids has promoted the progress of biochemistry and the development of a number of polypeptide drugs and nucleic acid drugs.

Some people believe that since developing nations are weak in S&T, they should devote their S&T resources to solving immediate and practical problems and should not spend effort on the development of basic science. Such a viewpoint seems harmful. In our experience, the development of science has several important functions: (1) the training of scientists, (2) the accumulation of knowledge, (3) international academic exchange, which is extremely important for S&T development, and most importantly, (4) it allows us to solve our S&T problems on our own. Although a developing country does not need to solve every problem from scratch, such a country cannot follow others on everything. Without its own base, a developing nation cannot easily absorb imported technology let alone make its own innovations.

Of course, we also realize that some developing countries have neglected to solve practical S&T problems, resulting in the idling and even massive outflow of talent. Developing countries should therefore always give top priority to solving their own S&T problems.

There are always gaps between idealized models and reality and between what scientists think they should do and what the public and administrative leaders want them to do. A country that has low standards of S&T and economic development and that is determined to strive for rapid development will invariably pay more attention to immediate problems, and when the economy is not going well, that country will demand even more that S&T resolve those immediate problems. This kind of mentality is understandable and well-intentioned, but the end result is not always desirable. Although there are many reasons for the low quality of China's semiconductor devices, the slow development of computers and the lack of innovations in many areas, this kind of mentality is one of the important reasons.

Besides properly handling tasks and disciplines in long- and short-range planning, there should also be an appropriate divisions of labor and responsibility. For example, the Chinese Academy of Sciences and universities should make more efforts in basic and applied research. Setting rough proportions is one method that will facilitate timely control and coordination. For instance, the Chinese Academy of Sciences has determined that 15 to 20 percent of its work should consist of basic research, 65 percent should be applied research and the rest should be development work.

The Question of Centralized and Unified Planning Verses Decentralized and Flexible Planning

Centralized planning has often been criticized for its excessive control, its lack of freedom and being detrimental to scientific development. But in order to change the reality of poverty and backwardness in China, we must apply our limited resources effectively in crucial areas. Generally speaking, compared to developed nations, we have inadequate human, financial and material resources, but through proper planning we can concentrate more of these resources in areas crucially important to the fate and future of the nation. This was the primary reason why China was able to develop the atomic bomb, the hydrogen bomb and

satellites under the economic and technological conditions of the 1960s. And this was also the reason why China could independently accomplish some large-scale economic construction projects under adverse international conditions. It is fair to say that some people often underestimated us because they could not perceive this point.

Naturally, this approach had its problems too. Although it had the ability to make breakthroughs, many difficulties were encountered when the approach was extended. These were often related to the entire industrial base and technological capacity. Insufficient understanding of this point often led us to overestimate ourselves in certain areas and to set overly ambitious goals.

Centralized planning has often been mistaken as necessarily proceeding from top to bottom and being prescriptive and hence inflexible and detrimental to free exploration. But in fact there is a bottom-to-top stage precedes determination of the top-to-bottom plan. In this process, departments and local areas first submit their proposals, and collective discussions are then held among respective leaders and specialists to formulate a draft of the plan. In such discussions, cooperation among departments is coordinated on a national scale, redundancy is avoided and major oversights are detected. Large-scale engineering projects, the establishment of agencies and the distribution of funds naturally require overall balancing by departments in charge. In this process, the initiative of lower levels is not constrained. The roles of the government and planning in basic research is threefold: (1) providing guidance in direction, (2) lending support (after comprehensive balance is achieved) and (3) providing coordination. The question of interference with the specific content, methods and procedures of research simply does not exist here. Engineering projects and key S&T problems in national development require enhanced planning and management in any country. Relatively speaking, China did not go too far in this area; in fact, China did not go far enough.

Of course, this does not imply that the present system is perfect. The major problems with the current system are as follows:

1. The scale of S&T development is dictated by the economic situation. In a country such as China where agriculture carries big weight, agricultural production has a great effect on the entire national economy. And, to a large extent, agricultural production depends on the weather, and thus economic conditions often fluctuate. Politics naturally has its effects too. In S&T, there has been considerable development during the last 30-some years, but that progress was not a steady improvement but a fluctuating process.

2. The scope of planning has been too large and its content, too complex. Planning has encompassed all the work of any significance in all departments and localities. Some experts are now studying and experimenting with an approach by which major and comprehensive projects will be handled by the state while production departments will be encouraged to sign contracts with research and teaching units

directly. The funding method is also being tried out; for example, the Chinese Academy of Sciences has begun to establish a science fund for the support of fundamental work in basic research and applied research. The three types of funds under the control of the State S&T Commission (the new-product experimental production fund, the intermediate experiment fund and the supplemental fund for priority scientific research projects) will be included in the key-project fund. The pace of reform in these areas will naturally depend on the pace of reform of the entire economic system. Such reforms will allow the state to concentrate resources on some high priority projects and in the meantime will provide departments, local areas and grass-root units more autonomy and flexibility so that research and production may be tightly integrated.

3. At the present time, S&T planning is mostly limited to central departments and generally does not include research and development efforts in enterprises. But enterprise research and development is a very important foundation, and weakness in this area would invariably affect the application of research results or force specialized research institutes to spend great effort in developing specific production techniques. An encouraging sign has emerged in recent years along with the reform of the economic system, that is, there has been considerable growth in research and development work in small and medium-sized cities and enterprises, which growth has greatly promoted the use of new technology in, and improved, production.

4. Projects in S&T generally take into account the needs of social economic development, but there are still some problems regarding society's ability to absorb and utilize research results. More study must be done regarding the coordination of scientific and social economic planning so that S&T may be better serve economic development. It appears that in the short run we should concentrate on the extension and application of research results and on mobilizing S&T personnel to participate in national, regional, industrial and enterprise planning. Our intermediate goal should be joint assaults on key tasks, and the long-term problem will be to formulate projects incorporating S&T, economic and social development.

Division of Labor and Cooperation

China's policy and planning in S&T are centralized and multileveled, not pluralized. The division of labor takes place under unified leadership. Of China's five S&T areas, the Chinese Academy of Sciences stresses basic research and pioneer work in new areas, and the academy's primary duty in national economic development is to solve major, comprehensive and key S&T problems. In short, the academy is characterized by its fundamental, pioneering and comprehensive nature and serves as the comprehensive research center of natural sciences in China. Universities also primarily engage in some applied, basic research, and engineering colleges mostly conduct applied research

and develop technical sciences. Research centers of various industrial departments mainly engage in applied research and development work and a small amount of basic research. Local research institutes, including research and development departments of enterprises, primarily serve immediate and local tasks in development work and product research. This is of course a crude division, and there will always be some overlapping. The present problems are dispersion and redundancy. Different views on how to deal with these problems are currently under discussion and study.

In order to organize scientific research efficiently and to improve the level and performance of research, peer review will be strengthened and state allocations will increasingly take the form of a fund in the area of basic research. In solving problems in national development, experience has shown that our S&T key-task approach has proved effective. The unique features of this approach are: (1) well-defined goals and time limits, (2) departments and professions are united under these goals, and there is a division of labor and (3) research, development and production are well integrated.

Today, the top priority projects in China are computers, large-scale integrated circuits, comprehensive control and development of the Yellow, Huai and Hai He plains, construction of Shanxi energy bases and application of remote-sensing technology. For example, 20 research units of the Chinese Academy of Sciences; departments in charge of coal, chemical engineering, mechanical engineering, transportation, electric power, geology and water conservation; and a number of universities participate in the key shanxi coal-base construction project.

Central departments and local areas have their own key projects. The ten special projects, including optical communication, organized by Shanghai Municipality in 1978 have produced good results.

It is fair to say that organizing S&T key tasks is only one of the important means of providing for division of labor and cooperation. Other approaches include establishing technical development centers for each industry and developing various forms of integrating scientific research and production.

Brief Conclusions

1. As a socialist state, China is developing its economy in a planned fashion and has the need and the capability to develop its S&T through planning.

2. As a developing country, China is conducting modernization to change its state of poverty and backwardness. China must therefore concentrate its limited S&T resources in important areas through planning.

3. Long- and short-term planning work can be improved in many aspects, and progress should be made on the basis of past experience and lessons.

4. Today countries with different social systems are exploring their own policies of S&T development. Western countries are also trying to develop their S&T in a planned fashion through government intervention. Some countries formulate medium- or long-term national national projects, some formulate projects for a certain area or industry and others propose guiding opinions or specific policies to encourage private investment in certain areas. Even China, a country with an essentially planned economy, is undergoing a number of reforms and adjustments to give departments, local areas and grass-root units more autonomy. Countries with different social systems can therefore exchange experiences and learn from each other. We should absorb the strong points of other countries, but we must come up with our own methods to suit the situation in China.

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DEVELOPMENT OF SCIENCE, TECHNOLOGY DISCUSSED

Beijing ZIRAN BIANZHENGFA TONGSUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese No 2, 10 Apr 83 pp 73-74

[Article by Li Xiuguo [2621 4423 2654]: "Notes on the Third National Symposium on the Science of Sciences and the Policies on Science and Technology"]

[Text] The Third National Symposium on the Science of Sciences and the Policies on Science and Technology jointly sponsored by the Chinese Academy of Sciences and the Scientific and Technological Policy Research Association was held in Nanning, Guangxi, from 18 to 26 December 1982 and attended by more than 200 experts, scholars and scientific and technological management workers from 29 provinces, cities and autonomous regions throughout the nation.

The central topic of discussion was: exploration into the relations of science and technology with economic and social developments and discussion of the principles and policies of science and technology in serving the strategic goal of quadrupling the total industrial and agricultural output value by the end of the century. There were intensive discussions in four aspects, viz., the developmental strategies, policies and management of science and technology and the theory of the science of sciences.

The meeting felt that we must clearly recognize that, in spite of certain difficulties and unfavorable factors, China's science and technology are in the course of entering the second golden age, and that we must serve as promoters of scientific and technological development.

The first golden age of China's science and technology was from 1956 to 1964. During this period, Premier Zhou and Vice Premiers Chen Yi and Nie Rongzhen personally handled science and technology and won a series of great victories, including the asscent of the "dual bomb explosion" [atomic device]. However, it was interrupted by the interference and disruption of the 10-year turmoil created by Lin Biao and the "gang of four." At the 1978 national mass meeting on science, Comrade Deng Xiaoping proposed that "science and technology are productive forces" and "intellectuals are a part of the worker class," the two famous axioms, thereby heralding the arrival of

the springtime of science. After the 3d Plenary Session of the 11th Party Central Committee, especially at the party's 12th Congress, developing science and technology was made into a strategic emphasis, signifying the entry of China's science and technology into the second golden age. This age has five outstanding characteristics: 1. Developing science and technology has become the great common struggle goal of the entire party and entire people. 2. The achievement of the strategic goal of quadrupling the total output value of the national economy by the year 2000 proposed by the 12th Party Congress hinges on science and technology. Science and technology are a powerful force to remold not only the economy, but also society. 4. Discovering, training, cherishing, organizing and fully employing talents have become the foremost task to achieve modernization. 5. A new situation will emerge in international interchange and cooperation, and the two-way flow of science and technology is in the course of expanding.

The comrades welcoming the second golden age of China's science and technology made the following proposal:

I. The development of science and technology is again knocking on the door of system reform.

The science of sciences workers felt that system reform is a most urgent issue calling for solution today. Certain scientific research and economic systems have become obstacles to the cause of developing science and technology. They are mainly manifested in three aspects, viz., "unit ownership," "large pot rice" and "iron rice bowl." Like the three big mountains, they press down on the heads of science and technology and their personnel. Their abuses are as follows:

1. The lack of vitality in the economic system made the industries lean on the state to share in the "large pot rice." With the excessive rigidity and control of the higher level on top thereof, the industries lack the impetus to seek new technology, stretch their hands to the higher level for help whenever problems arise, and have no energy to solve them themselves by adopting new technology. Thus, there is no economic impetus for the development of science and technology.

2. The scientific research units are departmentalized. All matters are communicated to the lower levels according to the rules and regulations; the research units are not competitive among themselves and seldom keep one another informed. The initiative and creative spirit of the personnel are restricted within the scope stipulated by the higher level, and they lack adaptability to the rapidly changing modern science and technology. Consequently, research loses its vitality, and it becomes difficult to develop the tremendous potential of science and technology. As a result, China's science and technology lack the impetus of science itself.

3. Those dedicated to science receive no encouragement, and the mediocrities are under no pressure. Unit ownership restricts the activities

of the personnel within the narrow world of the particular units. Because their achievements were not made in their particular units, many who made contributions to the state received no recognition, or were even harassed. As a result, China's scientific and technological personnel, to different degrees, lack the impetus to make contributions.

The science of sciences workers felt that the conditions discussed above are counter to the basic characteristics of modern science and technology. Modern science and technology have three most basic characteristics: 1. The influence of science and technology on economic development is rapidly growing, and economics has become the essential motive force stimulating the development of science and technology. 2. With the fierce competion in the world economic market and the rapidly growing capacity of scientific and technological development to gear itself to external changes, the adaptability of a country's science and technology to external demands and their own progress has become a part of its scientific and technological capacity.

3. Even though modern science and technology have become an undertaking of a social scale, they are still founded on the individual effort and struggle spirit of the scientists, and the development of the subjective initiative of the personnel remains the guarantee of achievements. Therefore, it will be difficult to develop science and technology without system reform.

The meeting proposed that the reform of the scientific research system first start with the personnel management system. We must liberalize the policies and permit the personnel to have a second job and receive more income. We must establish a responsibility system linking achievement, title and compensation, and emancipate the initiative of the personnel. With their enthusiasm, other reforms will have a foundation and impetus.

II. We must create strategies for scientific and technological developments compatible with China's national conditions.

After the founding of the nation, we made correct decisions and also followed detours on the strategies of scientific and technological development. Today, for science and technology to enter the second golden age, the scholars felt that the developmental strategies must follow the right track. Starting from China's practical conditions, the meeting proposed several strategies for reference and study.

1. The Strategy of Regional Economy

To implement the principle of coordinated development of science and technology, the economy, and society, we may, according to the economic characteristics, divide China into a number of economic regions, e.g., the Chang Jiang Delta, Zhu Jiang Delta, Song-Liao [Songhua Jiang-Liaoning] plain, Shanxi energy, Fujian coastal line to Guangdong's southeast coast, from the Guanzhong [central Shaanxi] plain to the western part of the

Gansu corridor, Yungui [Yunnan-Guizhou] plateau, Changbai Shan.... We may, according to the resources, economic developmental levels, technological foundations, geographical positions, educational levels and other social factors of the various areas, determine their goals and functions, and formulate thereafter appropriate scientific and technological programs and create distinctive scientific and technological regions centering around cities. Take the Chang Jiang Delta for instance: We may utilize Shanghai's technological superiority and the abundant resources and processing facilities in the surrounding areas to form a comprehensive economic region targeted at the international market. The region should focus development on acquiring the science and technology needed for occupying the international market. In terms of the Yungui plateau, we may utilize its abundant resources and stress the science and technology related to the development of hydroelectricity, nonferrous metals and medicinal plants. By so doing, we will overcome the maladjustments between science and technology, the economy and resources in administrative divisions which serve as the units for artificial economic regions.

2. Dominant Science and Technology Strategy

In view of the fact that it is impossible for any country to have all its science and technology in the leading position, some comrades suggested that we adopt the dominant science and technology strategy to determine the focal fields and industries for development, and achieve scientific and technological modernization step by step.

The basic thinking of the strategy is to make the selections on the basis of the developmental tendencies of science and technology themselves and according to three aspects, viz., social need and domestic resources, scientific and technological foundation, and economic level. We will select for development the branches of science and technology possessing resource superiority, favorable technological foundation, and economic feasibility and make them dominant. By means of the dominant scientific and technological branches, we will build dominant industries, produce dominant products, create an industrial system possessing the capacity for international competition, and establish a research system from basic to applied to developmental levels. We will integrate science and technology with economics, need with feasibility, advanced achievements with suitability, and basic research with applied and developmental researches. These comrades suggested that, as a pilot project, we utilize China's superior coal resources to focus on coal prospecting, mining, transport, liquefaction, gasification, and coal chemical and industrial technology create advanced dominant science and technology related to coal, and establish coal and chemical industries by means thereof.

3. The Strategy of Reverse Engineering

The starting point of the strategy of reverse engineering is as follows: Japan relied on the strategy of large-scale import, assimilation and remolding of foreign technology to rapidly achieve modernization. We

cannot follow Japan's path, but we may, by means of reverse engineering, rapidly master advanced foreign technology, instead of relying on our own studies to attain the level. It is a low cost and timesaving shortcut to achieve technological modernization. The meaning of reverse engineering is to make comprehensive, systematic and intensive scientific analyses and researches on imported advanced technology, learning not only the how, but also the why, mastering the technological secrets in the course of assimilation, and, by means of synthesis and innovation, accomplishing the result of comprehending the analogy and drawing inferences.

4. The Strategy of Stepped Transfer

As the scientific and technological foundations of the various areas differ, the levels are not the same, high along the eastern coast and dropping ever lower the further inland. Under this condition, how do we introduce advanced technology? Some comrades suggested the strategy of stepped transfer. In other words, we first introduce the most advanced technology along the coastal areas, and after assimilation, gradually transfer it inland by steps. By so doing, we will utilize the superior technological level and fast assimilation of the coastal areas and continuously transfer the advanced technology commensurate with their levels and suitable to them to the inland areas, thereby steadily improving China's science and technology.

III. We must earnestly study and solve a number of problems of a theoretical nature. The following must first be clarified:

1. The developmental laws of science and technology and forecasting.

2. The concrete mechanism of the interrelations of science and technology with economics.

3. The characteristics of scientific and technological labor and the evaluation of personnel.

4. The appraisal standards of achievements and the methods and procedures.

5. The theories and methods of the computation of economic benefits.

6. The means to obtain actual effect in scientific organization and in tackling key problems.

7. The expression and improvement of scientific level and results.

These problems relate to the formulation of scientific and technological programs, the establishment of responsibility systems, the reform of systems and the improvement of management. Only by clarification in theory and practice will the second golden age of science truly arrive.

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FORCES NEEDED FOR SCIENTIFIC PROGRESS DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 10 May 83 p 1

[Article by Gu Jiugang [7357 0046 4854], Shanghai Laser Institute: "Eight 'Forces' Needed to Initiate New Phase in Science and Technology"]

[Text] The Party Central Committee included in the documents of the "12th Party Congress" and the constitution the progress of science and technology as a strategic measure to develop the economy. All trades and industries have taken action to "rely on science and technology." What about the scientific and technological front? I feel that we must develop and apply "eight forces" as the motive power to intiate a new phase.

1. Political Motive Force. The most important motive force of a socialist country is the communist ideal. We must mobilize and educate all comrades on the scientific and technological front to fully realize that the lines, principles and policies of the party's "12th Congress" were painstakingly formulated and that they constituted a heritage and development of Marxism-Leninism and Mao Zedong Thought. We must urge them to devote themselves to the four modernizations and make suggestions on the fulfillment of the party's lines, in order to bring prosperity to the nation and promote the great cause together.

2. Economic Pressure. The most important economic pressure today is the responsibility system. The scientific and technological front, especially the applied science institutes, must introduce the financial responsibility system. Responsibility, authority, interest and result, the four elements, must be integrated. Each and every individual and each and every task must be linked to economic and social benefits, forming a pressure. Pressure is potential energy which can convert into kinetic power.

3. Policy Power. The policy of selecting and supporting the superior provides all kinds of necessary preferences to the engineering, technical and management personnel who, struggling on the front line of economic development, directly create productive forces. To propel the development of scientific and technological production, their titles should be

commensurate with their ability to solve problems and initiate a new phase in scientific and technological work. Policy is the precursor of science. When the policy is incorrect, we will be defeating our own purposes. When it is popular, the leaders and the masses will become more enthusiastic.

4. Joint Organizational Force. We must fully develop the superiority of socialist centralization and unity. The scientific research system must be reformed and the situation of five great armies each going its own way changed. We must coordinate research with the economic system and form a harmonious process from research to technology to production and marketing. When the state of the nation is "poverty and blankness," there is an even greater need for a joint effort.

5. Personnel Vitality. Running water is never stale. We must break down the unit ownership of talents and life tenure. The most effective means for the transfer and combination of technology, the flow of talents enables us to make the best use of men and their skills. Besides transferring those not suitable for research work to other appropriate posts, the best way to accomplish the flow of talents today is the recruitment system. Once this system is introduced, talents will emerge. We must first introduce it within the scope of our own provinces (cities). It will be feasible and most beneficial.

6. Actual Results. To serve the economy and become indispensable to it, science and technology, in the final analysis, must produce actual results. The results must be needed by production and in the market. Next, technology must be up to the mark and produce tremendous economic benefits. Only thus can it be deemed actual strength. Without actual strength, nothing can be accomplished; with it, the sky is the limit. Comrade Hu Yaobang's statement that we must "look for research projects in productive practice; pursue scientific research with a proprietary attitude" should serve as the action program of the scientific and technological front.

7. Management Potential. China's economic management is weak and backward; therefore, it has a great potential. We must demand economy, speed and productive forces from management. With the heavy burden and the long road ahead, the scientific and technological management cadres must vigorously learn scientific management and create a Chinese-style management science. If we say that mathematics, physics, chemistry and engineering technology are hard sciences, then management is a soft science. Only by "using both the hard and the soft" will we have full guarantee of success.

8. Leadership Courage. To do pioneer work, courage is essential. The "forces" discussed above all need courageous leaders to develop and put to practice. If the leaders fail to make decisions or to implement them, it will be difficult even to maintain the status quo, let alone initiating a new phase. If the leaders, regardless of their levels, fear difficulties and fail to make decisions, they will become passive.

The connotations of the eight "forces" discussed above are profound. When properly managed, the efficacy is inexhaustible. Proper management makes it possible for us to start at the right moment, from the right place and on the right path. Improper management leads to endless contradictions and misgivings, resulting in failure to accomplish anything.

6080
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STRONGER MANAGEMENT OF SCIENCE AND TECHNOLOGY URGED

Beijing RENMIN RIBAO in Chinese 17 Oct 83 p 3

[Article by Wang Ruifa [3769 3843 4099]: "Attach Importance to Scientific and Technical Management Work"]

[Text] With the high degree of development in science and technology today, it is necessary to pay special attention to scientific and technical management work, and scientific and technical management must be in accord with the law of development of modern science and technology and the law of economic development. Some people have analyzed and found that one-fifth of the scientific research plans in developed countries rely on funds and equipment, and four-fifths rely on scientific organization and management.

In the past several years, China has made great improvement in scientific and technical management work such as the selection of topics, the formulation of plans and the popularization of achievements. Yet, there are still quite a few drawbacks. For instance, decentralized management and inadequate overall balance have caused a great deal of unnecessary repetition in scientific research, and no one undertakes projects that should be undertaken. Due to lack of forecasting development trends, some research topics have a low rate of success and are relatively poor in economic results. The figures on 20 years of research topics at some research institutes show that in fact 50 percent stopped half-way and only 26 percent reached applicable standards. In view of this situation, when all concerned departments organize scientific research and tackle key problems they must do a good job in overall planning, overall arrangement and the division of labor, and must intensify coordination so that the set up, distribution, structure and subordinate relationships of scientific and research organs are rational, have defined tasks and concentrate on key problems. In addition, they must give research units more independence so that they will not be restricted by departments and can accept scientific research projects that cut across special fields and departments thereby enabling specialized research units to play their role effectively.

Modern science and technology develop in a way that overlap and permeate each other. To complete a key scientific and technological project often requires close relations among multiple disciplines and units as well as their vigorous cooperation. Quite a few of our units operate independently and are small and

complete. They have many administrative levels and procedures, are subject to mutual restraints and are difficult to coordinate. Generally, they feel a shortage of human, financial and material resources and have not yet given play to their role. Therefore, according to the characteristics of scientific and technical projects we should build a "resilient organization" and organize the management of trends and development. For example, we can tackle key problems by mobilizing the strength of the whole country. In this way, we can maintain the stability of the organized system of scientific research organs and facilitate concrete implementation of scientific and technical work, reduce administrative levels, simplify administrative procedures and increase the flexibility and effectiveness of management. This will facilitate the unity of strength, vigorous cooperation and overcoming difficult problems.

Under normal circumstances, the composition ratio of technical personnel at the senior, intermediate and junior levels should be "pyramid-shaped" or "triangular." The present structure of scientific and technical contingents in many scientific research units is not rational as the number of scientific and technical personnel at the junior level is smaller than that at the intermediate level. Such a condition not only directly affects the development of scientific research work but also affects the rejuvenation and growth of the scientific and technical contingents. We should promptly change such an imbalanced ratio through rational mobility and training of those who are qualified. At the same time, in the restructuring of scientific research organs, we should gradually realize the public use of large equipment and library resources and socialize the safeguard of logistic services, the supply of goods and materials, and services.

Most important in strengthening scientific and technical administrative work is to select and promote cadres in scientific and technical management who have both ability and political integrity. Based on the characteristics of scientific and technical management work, some people believe that cadres in scientific and technical management should have "moral character," "knowledge," and "ability." So-called "moral character" is good political and ideological moral character, which adheres to the socialist orientation and supports the party's leadership, has a relatively strong sense of the cause and the spirit to struggle, has a scientific attitude and the work style of seeking truth from facts, and can unite people and knows one's subordinates well enough to assign them jobs commensurate with their abilities. "Knowledge" means knowing one's profession (including social science and natural science particularly the basic knowledge within the scope of management). "Ability" is primarily the ability to organize and manage and to make policy decisions as well as the ability to create. Knowledge and ability are closely linked and they supplement one another, but the two can never be equal. A scientific and technical expert who is accomplished may not be a good administrator, and if we confuse the two we may be restraining what one can do well and forcing one to do what one is not good at, which will affect the work and waste talents. We can achieve good administrative results only by knowing one's subordinates well enough to assign them jobs commensurate with their abilities, develop what is useful and avoid what is not.

Systematic and goal-oriented training of qualified administrators is an important experience of developed countries. It deserves to be used for our reference. Judging by the present conditions in our country, the lag in scientific and technical management is more acute than that of science and technology, and the shortage of personnel in scientific and technical management is more serious than the shortage of qualified scientists and technicians. The main reasons of such a situation are: scientific and technical management has not been treated as a science for a prolonged period of time; underestimating the training, selection and promotion of qualified scientific and technical administrators; and the popular mentality of stressing professional techniques and not professional management. We are urgently in need of changing such a situation. It is hoped that more management colleges and professions will be initiated and operated and at the same time on-the-job rotational training of scientists and technicians will be promoted. In order to suit the needs of the four modernization program we must exert great efforts in many quarters and strive to create in a certain number of years a large number of administrative specialists who are more familiar with our national conditions and know their profession.

9586
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CALLING FOR STRONGER LEADERSHIP OVER SCIENCE APPLICATION, RESEARCH

Beijing RENMIN RIBAO in Chinese 26 Sep 83 p 5

[Article by Hu Shihua [5170 0013 5478]: "Some Views on Science and Scientific Research"]

[Text] This article represents the authors' views on certain problems relating to basic science, applied science and engineering science (technical science) as well as engineering and technology. Comments and criticisms are welcome.

Differences and Relationships Between Scientific Research and Scientific Application

There is a difference between scientific research and scientific application. "Science" and "the application of science" are two different concepts and the nature of work is also different. Science is a reflection of the objective laws governing the different bodies of knowledge in the fields of nature, society and ideas; the application of science refers to the application of these bodies of knowledge to solve various problems in material production and in society. For example, it is necessary to use science to solve the actual problems in the technical aspects of industrial and agricultural production, clinical work in hospitals and administrative work. It is most important that we apply scientific knowledge to solve various problems (application of science). It is necessary to apply science in various fields of work in order to succeed in our socialist modernization construction. It is only by applying science to solve problems that problems can be solved successfully and enable science to become a mighty productive force. Despite the importance of scientific application, it has yet to be made use of extensively in different fields of work. While the low scientific and cultural standard of the masses may largely be attributed to such objective factors as the undeveloped state of the economy, it is also due to such subjective factors as failure on our part to place emphasis on or to become sufficiently aware of the importance of scientific application, to appreciate the importance of science itself and to recognize the close relationships and differences between science and the application of science. Consequently, many scientists are not concerned with application; the various production departments, engineering and technical projects and major construction undertakings have failed to receive adequate

support from workers in the field of science. Under such circumstances, the work that is now being done will not effectively promote the development of science.

In China, the ratio of specialized scientists out of the entire population is extremely small. While workers can hardly be expected to change their line of work to engage in the application and exploitation (development) of science, they should be concerned with the role that science plays in various fields and they should be interested in the application of science, and they should take an active part in the field of applied science in general, especially in tackling technological problems. This does not mean scientists have to change their line of work. In order to use science, they must have some knowledge of and engage in the study of science. They cannot acquire scientific knowledge and make scientific progress without devoting themselves to the study of science. The application of science is not only of extreme importance; it is also mass-oriented. It is obvious that the 1 billion people should engage in the application of science, it is of vital importance to the future of the nation. People in general and those engaged in the field of science in particular have become keenly aware of the need to put as much emphasis on the application of science as the study of science. Some scientists are concerned that the emphasis put on the application of science will lower the role of science itself. This fear is ill-founded because the study of science is a prerequisite for the application of science. Without science, what is there to apply? The emphasis put on the importance of application is the basis for developing scientific research and not to relegate science to a secondary position or weaken the work of scientific research itself. "Modern science paves the way for progress in production techniques and sets the direction for development." I agree with this viewpoint because it reflects objective laws. However, this is not to say that science is more important than technology, both science and technology have an importance of their own.

Differences Between Applied Science and the Application of Science

Applied science is a science with direct application as its aim. Research in engineering science is undertaken to provide new tools and methods for engineering technology and of offering guidance to the development of engineering technology. It also is a science whose purpose is direct application. Obviously it is necessary to strengthen the study of applied science and the science of engineering in order to push forward socialist modernization construction and to raise the level of engineering technology. However, applied science and the application of science are not the same. The application of science is not necessarily the study of applied science. Some achievements resulting from the use of applied science and the science of engineering in our actual work do not necessarily have anything to do with research in applied science. For example, when an engineer is engaged in design, he must make use of applied mathematics, applied mechanics and other sciences. However, his work does not fall within the scope of applied science. Applied science is a science, and science seeks to discover objective laws and has a guiding significance; application is to accomplish concrete tasks. The confusion arising from the understanding of this problem

already has had adverse consequences for the development of science. This is evidenced by the fact that some scientific research departments do not engage in scientific research; they only engage in the study of development (exploitation) and production. This situation is likely to affect the development of science and technology.

While engaging in the work of development, extension and application, scientific research organizations can also engage in production to a certain extent. However, it is necessary to separate scientific research and production techniques departments because of the differences in the nature of their work, the laws and management methods. To apply the same methods to manage the work of two different natures will inevitably create unfavorable results. After being set apart, they can still make their views known and maintain a close relation and promote the development of applied science and engineering technology.

Basic Science Should Be Strengthened

The Party Central Committee attaches great importance to basic science, and believes that basic research must not be weakened. This view is derived from the overview of the strategic policy for the long-term development of socialist modernization construction and science and technology. The reason is obvious, the development of science and technology has to be backed up by adequate guidance and sufficient reserves.

Some research projects in basic science are not directly related to the development of production, and some require a great deal of investment. In the near future, it will not be possible to invest a greater amount of effort into basic scientific research of an experimental nature that calls for a great deal of manpower and material resources. Although this research is important, at present, we do not have the resources to engage in too many such projects. However, in the area of basic research, the more important projects do not necessarily cost more money; many important research projects cost little money or comparatively speaking they do not cost much. Some extremely urgent projects need to carry out research in a planned way. This type of research may be found in all research projects in the field of basic science or basic applied science.

In the field of basic science, special importance should be attached to research into basic theories that have a distinct and important significance, that have a vital bearing on the long-term development of science and technology and that are of an urgent nature. This type of research costs little, but has important significance. For instance, the dual bomb explosion [atomic device] would not have been achieved without the assiduous labor of theoretical physicists, and the recovery of man-made satellites would not have been possible without theoretical research into aerodynamics. With the advent of the communications era, our computer projects need to be greatly developed. Our computer and software industries both require the development of computer science and basic research into the theories of related sciences, especially those relating to mathematics. In all fields

of basic science, there are important basic theoretical research projects which do not cost a great deal of money. Our capacity for theoretical research is relatively strong. We should adopt concrete measures, give energetic support and promote research into basic theories in the various fields of science and technology. In this way, we can ensure the rapid development of technology in our nation and science and technology can be developed more rapidly and steadily in the right direction. This is something that merits consideration from the strategic point of view in developing the nation's strong points.

Basic science was ignored during the rampage of the "gang of four." After the smashing of the "gang of four," emphasis was placed on the study of basic science in order to set things right. However, sufficient emphasis was not placed on applied science, applied research and development. The view was prevalent in society (including scientific circles) that the more basic a science, the more important it was. In refuting this line of thinking, some scientific and technological cadres put undue emphasis on the importance of application. For this reason, it is necessary to discuss on an overall basis the emphasis put on basic science and the stepped up research on application and development. With regard to the relationship between science and the application of science, there is an opinion which arose during the 1950's, namely, "The Mission Determines the Science." This was looked upon at the time, in fact, as the science and technology policy to espouse, and the Chinese Academy of Science implemented it vigorously. I contend that, in view of the state of the country at that time, it was correct to push this policy, and it had good results. "The Mission Determines the Science" is a strategy that simultaneously considers both the mission and the science. If we are to accomplish the mission, then the mission drives [the choice of] the scientific discipline [to use] ("drives" means "spurs on" not "replaces".) At the same time, however, we must also do the science, which here include all those branches of science which are strongly theoretical. With the arrival of the 1960's, the idea that "The Mission Drives the Science" had a further development, whereby it was recognized that scientific research could not be limited to the sphere determined by the mission. What became clear was that the strategy "The Mission Drives the Science" was no longer adequate. Some important items of scientific research were taking place in advance of technological development, and to say "The Mission Drives the Science," therefore, is only the first line of the couplet. To come up with a good "second line," however, was not yet possible, for just then the "Great Cultural Revolution" broke out. During the "Great Cultural Revolution," not only was science negated, but--more seriously--basic theory was totally repudiated. All scientific theory was being denounced in the slogan "Theory is divorced from reality." We cannot forget this historic lesson.

Strengthen Scientific and Technological Leadership

Science and technology is an extremely complex system. The relationship between science and technology and their interplay are also complex. As in other fields of endeavor, the work of providing leadership in the field of science and technology has its special features.

The principles and policies on science and technology of the Party Central Committee were formulated with an overview of the new situation presented by our effort to promote socialist modernization construction. The work of providing leadership to the scientific research organizations at different levels (such as academies, institutes and offices) must be carried out in conformance with the spirit of the Party Central Committee. In providing leadership in scientific research, it is particularly important to give full play to the role of experts and to let a hundred schools of thought contend.

There should be a division of labor between professional scientific research organizations and production departments and organizationally they should be separated. The former are primarily concerned with research, and the latter are mainly concerned with production. It is, however, permissible for the scientific research organizations to engage also in some form of production. This is justified by the need to develop production as well as science, so long as it is not done at the expense of scientific research.

Scientists should not distance themselves from scientific research. They must take an active part in making technological breakthroughs. They must have an understanding of the situation, make known their views and engage in scientific research in the projects on hand. However, they should not be required to engage in actual engineering work of a technical nature.

Effort should be made to import the technologies that we need. However, since foreign countries are not likely to offer us technologies of vital importance, we must seek to develop the important technologies on our own soil. This can only be accomplished by the establishment of an integrated setup involving basic science, applied science, the science of engineering and engineering technology.

"Science" and "technology" are two different concepts. Although it is difficult to clearly define their separate spheres (extension), they have obvious differences in implication, objectives and types of work (connotation). This understanding is a matter of importance to those whose responsibility it is to offer leadership in science and technology. Research into the science of engineering technology is not necessarily of a technological nature. For example, the science of bridge building is not the same as bridge construction technology and medical science is not the same as the technology of treatment and diagnosis by clinicians. The purpose of technical education is the training of engineering and technical personnel. However, since it is the purpose of education to provide the students with scientific knowledge and training, it is not possible to develop technical cadres of a high caliber unless the scientific standard is raised. If the connotation of science and technology is not clearly understood, it would not be easy to engage in work of this nature.

The consequences brought on by one-sided slogans such as "taking steel as the key link" in economic development are obvious to all. It is necessary to engage in serious discussions and studies on how best to deal with the development of science and technology. It is not proper to direct strenuous efforts toward certain important branches of science and technology without consideration being given to the achievement of an overall balance.

9621
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FUSHUN'S MULTILEVEL DECISION MAKING SYSTEM DESCRIBED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 10 May 83 pp 12-14

[Article by Huang Weiguo [7806 4850 0948], Fushun city people's government: "How We Fully Developed the Effect of the Scientific and Technological Advisory Commission"]

[Text] Unlike the minor changes and improvements in single-item technology as in the past, the development of major modern technology involves the aspects of science, technology, economics and social life. In terms of such development, if we rely only on the personal wisdom of some few leaders and individual experts, it will be difficult to ensure the scientific quality and accuracy of the decisions. To avoid mistakes in major decisions, experts in all aspects concerned are usually organized according to certain organizational forms to make systematic investigations, studies and demonstrations. Regional technological development has an even greater comprehensiveness, because it involves not only the various scientific, technological, economic and social factors, but also the complex relations between the various branches and industries, including problems in resources, funds, systems and policies. Therefore, it is difficult to rely on the collective wisdom of one level only to solve the many kinds of problems confronting decision making. As shown by the practical experiences of Fushun city in the past several years, a multilevel decision making system is a desirable organizational form to make scientific decisions on regional technological development. It not only centralizes the region's experts and scholars in social science, natural science, engineering and technology and the leading cadres of the branches concerned, but also includes them in the decision making system composed of the city, branch and industry levels, thereby making it possible for all sides to mutually permeate and learn from one another and jointly solve the various problems encountered in decision making. This multilevel system is similar to a simple mechanics model: If each component represents the decision making direction of one level, then, while the various levels, due to division of labor or diversity of interest, cannot focus all their components in the same direction, they are all centralized in the same quadrant, and the maximum effect of each and every component is channeled toward the direction where the joint force is greatest. By

relying on such combined wisdom and interest, we fairly successfully solved the various contradictions emerging in the development of the entire region and obtained favorable results.

How was the multilevel decision making system of Fushun city organized and how does it develop its effect? Under the leadership of the municipal party committee and city government, the municipal scientific and technological advisory commission, the first level decision making organ, is responsible for the major technological and economic issues throughout the prefecture, mainly large technological projects. Formed in 1981, it served at the beginning as an ordinary advisory and consultative mechanism. Because of the important impact of its work of 1 or more years, the municipal party committee decided to change it into a decision making organ on major scientific and technological issues of the entire city. Under it are 17 specialized groups, including petrochemistry, coal mining, electric power, electronics, machinery, metallurgy, capital construction and building material, first light industry, second light industry, textile, agriculture, forestry, medicine and sanitation, livestock, energy, environmental protection, and finance and economics. Its work originates mainly from three sources: major study projects assigned by the municipal party committee and people's government; study projects submitted by the basic level and the consultative company; study projects of momentous significance suggested by the advisors.

After its formation, the commission used the system engineering viewpoint to demonstrate more than 10 major study projects which affected the overall situation. The petrochemical group, for instance, studied the proposal of the municipal petrochemistry institute to resume deep freeze processing and add production installations for 5,000 ton of low pressure polystyrene at the second petroleum plant. The commission conducted many-sided demonstrations on technological feasibility, economic rationality and overall social benefit, sent a team of more than 10 members to visit related industries in the country, and organized, through the scientific and technological consultative company, the plants concerned to prepare the petrochemical overall development plan. The plan received the support of the provincial and central departments concerned, and six petrochemical installations, including deep freeze processing by the second petroleum plant, were approved. After the plan is carried out in full, it will increase the output value by 370 million yuan and the profit tax by 125 million yuan.

Under the leadership of the municipal party committee, the municipal scientific and technological commission, the second level decision making organ, is an advisory organ on scientific and technological work and an executive organ to arrange cooperation and joint effort on key problems in the course of technological development. In recent years, it led and organized the projects of utilizing the cooled warm water discharged from the Liaoning power plant to raise African carp, utilizing warm water to irrigate vegetable crops, cultivation techniques for high-yield soybean, cultivation techniques for high-yield ginseng, and covering peanut crops

with plastic films. Fairly obvious economic benefits were obtained at fairly low cost.

The various institutes and the scientific and technological consultative company under the municipal scientific and technological association constitute the third level. The various institutes are both important fronts promoting academic exchange and organizations where talents gather. Linking with the various institutes, the scientific and technological consultative company utilizes the "spare energy" of scientific and technological strengths in all quarters in society, breaks down the fetters of "unit ownership" of talents, fully develops their technological expertise, and renders technological service to all units. Once proposed to the company, the technological problems, whether major or minor, receive attention. Under the premise of obtaining the support of the units concerned, it organizes, in such forms as borrowing and sparetime study and planning, the scientific and technological personnel of related fields to investigate and study the proposed problems, formulate plans and make designs until the emergence of effective methods of solution or technological developmental measures. Their activities have solved the difficulties in production or other aspects encountered by many units and produced good economic results. They receive compensation and the company draws activity expenses out of the economic results.

Besides gearing to the needs of society and rendering consultative service to the various units, the company, under the two higher levels, participates in making decisions and solving key problems of major projects. Since 1981, for instance, upon the proposal of the advisory commission, it organized the personnel of the three coal mines in the city to conduct detailed investigations and studies, and clarified the utilizable volume of gas in the mines. On this basis, the advisory commission made a study of using gas in the whole city. This highly beneficial project is in the course of being organized for implementation.

The scientific and technological associations of the various industries, the fourth level, serve as advisers on technological decisions of the industries and assist in their implementation. The Fushun excavator manufacturing plant found itself in a predicament because of inferior products and slow business. In January 1981, its scientific and technological association organized 80 engineers to make overall demonstrations of all its products in terms of their technological level, qualitative reliability, economic rationality and market competitiveness. Discussing the demonstrations and receiving enlightenment, the plant party committee proposed the conception of improving, manufacturing and developing the products in batches, organized the preparation of appropriate technological developmental plans and implemented them actively. To solve the shortage of technological strengths when improving the products, the plant scientific and technological association introduced the above-norm contracting system on the personnel and fully developed their enthusiasm and creative power. In barely a few months, several new products needed by society successively emerged. Users eagerly placed their orders and the plant extricated itself from its predicament.

Though their work spheres are somewhat different, the four levels do not perform their functions independently of one another; instead, integrating the higher and lower levels and closely cooperating, they have built a sort of organic relationship, resulting in rational solutions of technological problems of different spheres.

The solution of the coal dust pollution problem of the Fushun electrical power plant was the result of the joint effort of the various levels. In regard to the grade 2 dehydration technique adopted by the plant, the advisory commission organized the personnel concerned to carry out large volumes of experimenting, designing and demonstrating work and submit feasible plans. The scientific and technological associations of the power plant and the building material industry jointly implemented the concrete technological measures. The joint multilevel decision making and implementation made it possible for the project to produce a result rapidly.

As proved by practice, the scientific management of scientific and technological organizations often produce greater economic results than partial inventions and improvements. Vigorously adapting to the needs of socialized production in regional technological development and introducing multilevel decision making on a scientific basis have a positive significance in promoting the progress of the entire region as well as improving the economic results. At the national scientific and technological award mass meeting, Comrade Zhao Ziyang pointed out in his speech: "Organizing the scientific and technological personnel to participate in planning and in solving key problems is the responsibility of the leadership. A large-scale organizational work, it requires levels, steps and implementation in an orderly manner. We must, under the centralized planning and centralized command of an authoritative, efficient and capable mechanism, coordinate the work and strengths of all quarters." These words apply to a region as well as in the national sphere.

China's superior socialist system provides favorable conditions for us to organize multilevel decision making systems. The strategic goal of quadrupling demands that science and technology produce a greater impact and that our decisions be more scientific. We must practice vigorously, summarize experiences continuously, and make the multilevel decision making system more perfect and more effective in Fushun city's achievement of the strategic goal.

6080
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SCIENTISTS OFFER SUGGESTIONS ON DEVELOPMENT

OW130857 Beijing XINHUA Domestic Service in Chinese 1306 GMT 12 Jan 84

[By reporters Zhu Weixin and Wu Ming]

[Excerpts] Beijing, 12 Jan (XINHUA)--When the Fifth Scientific Council Meeting of the Chinese Academy of Sciences was in session, separate report meetings were held by all divisions of the council. At these meetings, academicians and specially invited experts introduced current trends in scientific development in various fields and discussed China's long-term plan for the development of science and technology. They also offered valuable suggestions on how to have science and technology serve the needs of our economic construction.

Geologist Cheng Yuqi said that since the distribution of mineral resources is quite uneven in our country, geologists should do good prospecting work according to available materials on geological data and mineral deposits so as to provide a scientific basis for the departments concerned to formulate their technology-related policies. He pointed out: Most mineral resources cannot be regenerated. However, some production units ignore the objective rules for the mining industry and arbitrarily seek high production figures. This practice ruins our mineral resources. To correct this state of affairs and to protect our mineral resources, he said, it is imperative to strengthen the management of mines, to raise their technological level, and in particular, to supervise their production by paying attention to the recovery rate of minerals, the depletion rate of resources and the efficiency of ore-dressing and smelting processes.

Metallic materials expert Shi Changxu said: In industrially developed countries, investment in materials research and development accounts for one-third of the total investment in science and technology. To meet the requirements of our four-modernization program, we should put emphasis on the following points in materials research and in developing our materials science: 1) the development of ordinary materials should be regarded as a fundamental task. In the Seventh 5-Year Plan period, particular attention should be given to the research and development of ordinary materials with a view to narrowing as much as possible the gap between our materials and those of international standards in quality, variety, and cost. 2) While going all out to develop basic materials, we should attach importance to the development of new materials and make this a priority task in developing new technologies. 3) We should devote more effort to materials-science research and put stress on popularization and application of the research results.

Yang Shiren, a specialist in remote-sensing technology, said: Remote-sensing technology is an important method of collecting data on the earth's surface. It can serve directly the needs of production and construction by providing much useful data for such work as surveying natural resources and monitoring the environment. He suggested that, in addition to accelerating the construction of a satellite ground station and popularizing the application of remote-sensing technology to various fields, the Chinese Academy of Sciences should designate several localities as experimental areas for making intensive studies of the application of these technologies. When planning research projects, he said, particular attention should be paid to utilizing the special advantages of these technologies to serving the urgent needs of the development of our national economy.

Sun Honglie, chairman of the Committee for Comprehensive Survey of Natural Resources under the Chinese Academy of Sciences, held that, with the development of the social economy and the growth of the population, there will be an increasingly acute contradiction between supply and demand in natural resources, and that we should view the question of exploring and utilizing natural resources as a matter of strategic importance and should plan for the benefit of our descendants. He said that personnel engaged in the study of natural sciences, technology, and economics should cooperate to carry out a comprehensive study of natural resources. Efforts should be made to bring about a diffusion and "Hybridization" of these three different disciplines so as to gradually form a new comprehensive science of natural resources.

Professor Zhang Guangdou of Qinhua University pointed out: The distribution of water resources in our country is quite uneven. This, coupled with other factors, has resulted in a number of problems, for example, low water-supply capacities, remarkable contradictions between supply and demand in water, an imbalance between farmland and water resources in the north and south, an insufficient amount of work on the multipurpose utilization of water resources, and the increasing extent of water pollution and waste. With the development of economic construction he said, the demand for water in our country will increase immensely by the year 2000. Because of this, he suggested that a law on water resources be enacted. It is imperative, he said, to strengthen the scientific management and protection of water resources, to prevent water pollution and soil erosion, and to derive greatest possible benefit from the multipurpose utilization of water resources. At the same time, he suggested, efforts should be made to strengthen the overall planning and strategic study of water resources, to study and work out means and measures to solve the water shortage in the north, and to strengthen the scientific research, survey, and assessment of water resources.

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CONFERENCE SPEECHES REPORT PROGRESS IN S & T WORK

Beijing GUANGMING RIBAO in Chinese 22 Dec 83 p 2

[Article: "Further Implementation of the Strategic Policy of Scientific and Technological Development: Selected Speeches by Delegates to the National Scientific and Technological Work Conference"]

[Text] Courageous Reform and Effective Reorganization of Scientific Research Units

Vice Minister of Chemical Industry Yang Guangqi [2799 0342 0796]:

Scientific research should serve economic development. At present, however, research units under the Ministry of Chemical Industry fail to meet this need in four areas: research management lacks initiative in serving economic development; research units are overstaffed, duties, rewards and punishments have not been clarified, and management work is inefficient; researchers' learning is out of date; and leadership is overstaffed, overaged, poorly educated, unspecialized and has been unable to develop a powerful research command system.

Since April 1982, we have conducted a full-scale reorganization in order to correct this state of affairs.

Believing that the key to this work lay in the establishment of a good leadership group, we began with two reforms of the cadre management system: we instituted fixed terms of office for all levels of cadres and nomination by the institute's director of all middle-ranking cadres. When their 2- or 3-year terms are up, cadres are subjected to opinion polls and to evaluation by the organization. Those cadres who perform their duties competently are reappointed, while the unqualified are dismissed. Newly promoted cadres, if dismissed, are not permitted to retain their original salaries. The masses approve of these reforms, and everyone remarks that the reforms have two good points: cadres' sense of responsibility is enhanced by the distinction made between good and bad work; and the masses now exercise real power of supervision over cadres.

A conscientious reorganization of cadres in the research and technical offices has been effected through opinion polls, the organization's evaluation,

nomination by the institute director and approval by the party committee. New arrangements, based on actual conditions, have been made for comrades unsuited to leadership work. For example, old or infirm comrades who cannot handle work on a regular basis have been assigned to investigative research; unindustrious or irresponsible cadres have been reassigned to normal work; and retraining classes or arrangements for other work have been provided for those cadres who are poorly educated or inefficient.

To date, 21 of 26 leadership groups in the institute have been reorganized. Leadership cadres of the first rank have been reduced by one-fourth, their average age has declined from 54 to 49 years, 60 percent have college-level educations, and 74.6 percent occupy technical positions. Thus the leadership has been revolutionized and made more youthful, expert and specialized.

Achieving High Wheat Production Through Reliance on Progress in Science and Technology

Li Changze [2621 2490 3419], Chairman of the Henan Science and Technology Commission:

In 1974 the Henan Provincial S & T Commission collaborated with other relevant agencies to establish the "Henan wheat high yields, stable output, high quality and low cost research and extension team." In the last 10 years, this team has achieved two major successes: "implementation of the wheat high yield, stable output, high quality and low cost production model" and the Henan Provincial Regulations Governing the Productive Techniques for Wheat on Plains of Differing Ecological Types." Relying on policy and science, the team promoted large increases in wheat production across the province.

During the joint assault on this key problem, Henan Province combined research on the application of S & T; on experimentation, demonstration and extension; and on scientific organization and management. The approach included five concrete methods: (1) We stressed key links and made steady breakthroughs. We expanded wheat production on the reliable foundation provided by progress in S & T; and we steadily localized cultivation, standardized management and established technological indices. (2) We defined tasks and provided for rational division of labor. Based on the need for unified planning, unified standards and unified design, we first established a general plan for our joint assault on this key problem. Then we defined the division of labor and set different tasks and expectations for agricultural colleges, research units and departments; experimental and extension units below the county level; and each locality and city. (3) We linked top and bottom into an integrated system. We organized researchers, extension workers and managers from each department and discipline into specialized research teams for cultivation, breeding, quality analysis, irrigation, soil fertility, crop protection, physiology, meteorology, agricultural economics, demonstration, extension and reporting. Thus we formed an integrated, multidisciplinary research system that linked top and bottom. (4) We established bases and placed great emphasis on demonstration work.

We initiated "100-mu experimental fields," "1,000-mu demonstration districts," "10,000-mu development regions," "S & T demonstration households," "key demonstration communes," and "key development counties" in order to create a network in which "10,000 leads 100,000, 100 districts lead 100 regions, 10 counties lead 100 counties and the entire province becomes a whole." (5) We used many channels to extend our achievements. We concentrated human, material and financial resources in demonstration and extension and the dissemination of technological application; and we used various forms of propaganda to spread S & T and nurture peasants' technical skills.

Serving Economic Development and Doing S & T Work Well

Li Fan [2621 5400], Chairman of the Shandong S & T Commission:

When preparing its plan, Shandong Province paid attention to the salient fact that agriculture is the foundation of the economy. For many years, we have ranked agricultural technology first among all S & T work in the province and have focused our efforts on the following key areas.

1. We have vigorously promoted the technological development of medium- and low-output fields. Medium- and low-output fields comprise more than two-thirds of the province's cultivated area, and the yields of low-output districts are less than one-half of those of high-output districts. In order to resolve this key problem, we initiated comprehensive development of medium- and low-output fields. Three years of practice have demonstrated that this method was good and that it achieved marked increases in production. Six crop types showed an average yield increase of 30 percent over the 3 years prior to the experiment, and the output of some crops doubled. Little research investment was required, and rapid and large results were achieved. Returns on cotton investment were greatest: 104.1 yuan for every 1 yuan spent. We trained a large corps of agricultural technicians, made a major technological breakthrough in increasing output and accelerated application of the fruits of scientific research to production. For the first time, provincial grain output topped 50 billion jin and cotton production exceeded 20 million dan this year.

2. We conscientiously stressed the technological development of mountainous areas. Mountains comprise over one-third of the province's total land area, have abundant resources and tremendous potential. Nevertheless, mountainous areas are backward and their populations, impoverished. We have achieved marked results in 3 years of technological development of these areas. Fei County, for example, made important breakthroughs in increasing production of Chinese chestnuts and Chinese hawthorns, earning returns of 15 million yuan on 500,000 yuan invested.

3. We diligently conducted "comprehensive surveys and development of shoal resources" and coastal areas. Shandong has more than 3,000 kilometers of coastline. Shoals are extensive and possess the most abundant resources in China. Yet this advantage has not been fully put to use. Over 90 percent of the province's exploitable shoals remain unused. To develop this

resource, we are conducting a comprehensive survey of coastal and shoal resources. This work began in 1981, and after 3 years of effort, we have completed surveys of the areas near the mouth of the Huang He, Qingdao and Yantai. It is estimated that the remainder of this work will be completed in 1985.

Developing Xinjiang Through Reliance on Progress in S & T

Song Hanliang [1345 3352 5328], Xinjiang Uygur Autonomous Region Vice Chairman:

During the 34 years since Liberation, Xinjiang took the first steps toward establishing an economic system that has its own distinctive characteristics and that can give full play to the region's advantages. In accordance with Premier Zhao's directive on Xinjiang's development, 11 key research projects have been proposed for the region's S & T work. The most important of these concern resource development; agriculture, animal husbandry, forestry and improving the ecological environment; food processing, textile and petrochemical industries and agricultural mechanization; energy development and energy-saving technology; and development of communications, transport and building materials.

In order to complete these key S & T tasks, we must pay special attention to and proceed from Xinjiang's actual conditions; tailor measures to suit local conditions; and place special emphasis on "making three research areas primary": development, productive technology and the introduction of new technology. This constitutes the shortest route to the advancement of Xinjiang's S & T work. To develop Xinjiang, we must develop human resources; devote great effort to improving the work and the learning and living conditions of scientists and technicians; stabilize the ranks of these workers; and steadily improve the quality of these workers. Meanwhile, in accordance with Xinjiang's developmental needs, we must mobilize and organize even more scientists and technicians so that "knowledge supports the frontier." In the future, we must continue to emphasize basic education at the primary and middle-school levels and construct more schools in agricultural and herding districts. Yet at the same time, we must also undertake more middle-level technical education and train a large corps of low- and middle-level technicians. And we must develop many different forms of higher education, accelerate technical training and steadily create a corps of scientists and technicians that is suited to Xinjiang's development.

Giving Prominence to Key Tasks and Stressing Integration of Scientific Research and Production

Fan Hongcai [5400 1347 2088], Vice Director of the S & T Bureau of the Ministry of Machine Building Industry:

We have given prominence to key tasks and stressed integration of scientific work and production. At present, a major shortcoming in scientific research

and the economic system is the divorce of research from production. In order to resolve this problem, the Ministry of Machine Building Industry has adopted effective measures and created various types of integrated bodies combining research and production.

The best of these entities that have emerged from the ministry since 1980 include the China Combination Machine Tool Co, the China Microelectronics Co, the China Molding Materials Co, the China Casting Instruments and Metering Co and the experimental plant of the Shanghai Materials Institute. These companies are integrated bodies combining research and production; were formed under the aegis of research institutes in cooperation with several factories; and feature the linkage of planning, research, manufacturing and sales into a single, coordinated process. Both institutes and factories benefit from this arrangement, and thus it is attractive and has been consolidated and developed. Notable success has been achieved in the areas of sales and technological development. For example, the China Combined Machine Tool Co, led by the Dalian Combined Machine Tool Institute and involving 18 key enterprises in that industry, produces about 800 of each type of combined machine tool and accounts for more than 90 percent of the industry's total annual production value. The China Microelectronics Co, which is led by the Xi'an Microelectronics Institute and involves 11 factories, annually produces more than 2.1 million devices, worth over 15 million yuan, and accounts for more than 90 percent of that ministry's output of microelectronic devices.

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SUCCESS OF FOUR MODERNIZATIONS LIES IN RAISING SCIENCE, EDUCATIONAL LEVELS

Jinan DAZHONG RIBAO in Chinese 2 Jun 83 p 4

[Article by Li Qingzhen [2621 1987 5271]: "Enhance the Understanding of the Strategic Importance of Science and Education"]

[Text] Our strategic goal is to maintain continuous economic growth and to quadruple the industrial and agricultural output by the end of this century. To achieve this goal, we must concentrate on three strategic issues: the problem of agriculture, the problem of energy resources and transportation, and the problem of education and science. To consider education and science as a strategic issue is of particular significance.

The growth of national economy depends on: 1) expansion of the labor force and 2) increase in production efficiency; in particular, the latter factor plays a more important role. To increase production efficiency depends primarily on advancement in science and technology. It is estimated that approximately half of the increase in gross national product of the United States is due to increase in the education level of the labor force and application of the results of scientific research. If this country is to quadruple its national economy, at least half of the increase must rely on progress in science and technology. If by the year 2000, we are able to deploy in this country the basic technologies which prevailed in developed countries in the late 1970's and early 80's, then we have confidence in achieving the goal of quadrupling output. Comrade Zhao Ziyang pointed out in his book "A Strategic Problem of Economic Growth": Economic growth depends on advancement in science and technology; this basic rule should be the guideline for economic development in this country. This guideline also reflects a fundamental law in the economic development of other countries in the world. The history of economic development in other countries has proved that once science and technology are used in actual production, they become a strong and active production force of the society. Therefore, we must acknowledge the idea that advances in science and technology are essential to achieve the goal of modernization and economic growth, and the goal of quadrupling output.

The problem of agriculture is also an important strategic issue. There are two basic aspects to solving the agricultural problem: policy and science. With regard to agricultural policy, a sound system of agricultural production

responsibilities must be established to provide incentives for the farmers and to increase production. In addition, agriculture must rely on science to cultivate new species, and to find a way to introduce mechanized and scientific methods to agriculture which are compatible with China's rural structure. It is quite obvious that China's agriculture is far from being modernized. In 1981, the production value of each farm labor force in this country was 560 yuan; the amount of food produced was around 2,000 jin, which corresponds to only 1.3 percent of the value produced by a farm labor force in the United States. Therefore, we must strive to modernize China's agriculture, and to solve this important strategic problem. The key to solving the problem is to develop a sound system of production responsibilities, and to implement policies which will motivate farmers to use scientific and mechanical methods in agriculture. Similarly, to solve the problems of energy resources and transportation also depends on the application of advanced science and technology.

Economic development requires capital. An important source of capital is provided by science and technology. Comrade Zhao Ziyang said: "Progress in science and technology can produce revenues; major technological advances can often generate large fortunes for the State." Last year, 13 major inventions in this country are generating 3 billion yuan per year for the State. Specialists at the State Council indicate that putting 100 million tons of petroleum to good use can produce 10 billion yuan of revenue. The Xiangfan City, Hubei Province doubled its production in 3 years primarily with the help of science and technology. According to statistics, technological advances were responsible for 29 percent of the total industrial output during the 3-year period and 45 percent of the profit growth. The rapid growth of industrial output in Weihai and Yantai, Shandong Province was also attributed to new developments in science and technology.

Progress in science and technology not only assures the development of materialistic civilization but also provides favorable conditions for spiritual and cultural development. The contributions of science and technology to cultural and ideological development are quite evident. For example, extending scientific knowledge to the people will eliminate superstition and contribute to the establishment of the world view of materialism; publicizing the spirits, attitudes, and life stories of scientists will contribute to the cultivation of the morality of communism. As a specific example, learning and illustrating the works of scientists Jiang Zuoyin and Shen Fupeng had a noticeable effect on the development of socialism.

Progress in science and technology is closely related to investment in intelligence because human resources are essential for the development of science and technology. To cultivate human resources, it is necessary to allocate funds to develop a good educational system. Some people are not willing to spend money on education because they feel that expenditure in education is basically non-productive. This view and this policy are incorrect. Admittedly, investment in education is different from material investments such as building factories and purchasing equipment, but it is neither a pure consumption type investment. In fact, it is a productive

investment because education can not only produce material wealth but also cultivate human resources which provide the necessary scientific talents for production development. Some analysts have studied the reason for Japan's success in developing into a major economic power from a nearly bankrupt nation in only 3 to 4 decades after the Second World War, and found it to be closely tied to Japan's emphasis on education. From 1950 to 1972, Japan's education funds increased by a factor of 25, and its gross national product increased by a factor of 29. Their experience contains a valuable lesson for us to consider.

In summary, the key to achieving the four modernizations and quadrupling output is to concentrate our efforts on science and technology. Developing science and technology, on the other hand, depends on human resources. Therefore, the ultimate key is to expand the scope and raise the standard of education. We must have a good understanding of this problem and devote our best efforts to this important issue of science and education.

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ON THE ECONOMIC RESULTS OF SCIENTIFIC, TECHNICAL PROGRESS

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 12, 10 Dec 83 pp 2-5

[Article by Hu Jinxiang [5170 6651 4382], the CCP Party School of Nantong City Committee, Jiangsu Province: "Preliminary Explorations in the Economic Results of Scientific and Technical Progress"]

[Text] Scientific and technical progress is one of the three major factors for improving the economy of a society. It is the most active and positive factor. It is very important to study the economic results of scientific and technical progress to promote the integration of science and technology and the economy and enable economic development to rely on science and technology and science and technology to be geared to economic construction. In order to evoke discussion, I offer my own views on the subject.

Significance of Scientific and Technical Progress and Economic Results

It is a well-known fact that the essence of the problem of economic results is an evaluation of the consumption of labor or of the degree of economy achieved in labor conservation. Science and technology is a part of the productive force. The development of science and technology should inevitably be able to conserve the consumption of social labor, and create more material wealth. To study the economic results of scientific and technical progress is to evaluate the effect of scientific and technical achievements on the various factors which influence production, to promote socioeconomic growth and decrease the degree of labor consumption.

From scientific study to application in production involves four links: Science-Technology-Production-Utilization, i.e., scientific research, technical developments, production of new technical achievements and application of scientific achievements in production. The four links represent the whole course of transforming science and technology into a direct productive force, each link is closely related to the other. The preceding link becomes the basis for the following link, guiding the development of the following link. The development of applied sciences depends on the degree it can employ the basic sciences. The progress of technical developments is determined by the degree it applies

scientific achievements in the course of research and development. The development of production is directly related to achievements in scientific and technical research. From the angle of economic results, the previous three links do not play a practical role in scientific and labor achievements, sooner or later, these achievements will be adopted for use in one form or another, thus bringing about economic results. Achievements in scientific research can be regarded as latent economic results. The fourth link represents the popularzation and application of scientific achievements in production, the economic results are obvious and practical.

From the above analysis, we can divide the economic results of progress in science and technology into three aspects, latent economic results, practical economic results and social benefits.

1. Latent economic results are the economic effect of the scientific research departments. Before achievements in scientific research are applied to production, they belong to the state of knowledge, or a potential productive force, they have not been transformed into a material force, or a direct productive force. Some achievements in scientific research belong to the category of basic theory whose objective is to explore the unknown. Because of the limitations of time, conditions and technological level, they cannot be put into production; however, they have latent economic results.

2. Actual economic results are the economic results of scientific and technical progress in the course of production, and the actual economic results obtained by production departments, enterprise expansion and the application of scientific and technical achievements. Scientific and technical research create beneficial conditions to raise economic results; but the economic results of scientific and technical progress can only become a reality in actual production. Knowledge as a productive force is transformed into a direct productive force and eventually will burst into an enormous force which will bring about visible and practical economic results.

3. Social benefits are the indirect economic results people derive from applying new achievements in science and technology, new techniques and new equipment in the course of production. Its major manifestations are: decrease in physical labor, increase in creative and mental labor, full employment of the labor force and improvement of labor conditions, gradual reduction in the socioeconomic differences between urban and rural areas, natural resource conservation and comprehensive utilization, environmental protection and ecological balance, etc.

Latent economic results are the basis for actual economic results. Actual economic results and social benefits are produced simultaneously during the popularization of scientific and technical achievements and application in production. The degree of actual economic results is a gauge for the economic results of scientific and technical progress. Consequently, in our investigation and discussion of the economic results of scientific and technical progress, the emphasis is on actual economic results.

The economic results of scientific and technical progress can be divided into three aspects. The merit of such divisions is for scientific and technical personnel at each level to clearly understand the realm of the activities and the path each level should follow in an effort to increase economic results through scientific and technical progress. Personnel should understand the interaction of the economic results at each level and serve the requirement that they should seek economic results of scientific and technical progress as a whole rather than just for the economic results at their own level.

Factors Affecting the Economic Results of Scientific and Technical Progress

Information provided by the bureau of science and technology information in Hebei Province shows that from 1952 to 1980, output value of industrial enterprises owned by the whole people have an average annual growth of 10.6 percent, of which, 53.5 percent is due to growth of fixed assets, 30.7 percent is due to labor growth, and only 15.3 percent depends on scientific and technical progress. In the development of the national economy, the results of scientific and technical progress is not notable.

Examining the three aspects of economic results of scientific and technical progress, we see that in China it is wanting. It is not because latent economic results are low nor social benefits are poor. It is because actual economic results are poor. The factors which affect the actual economic results of scientific and technical progress are:

1. Poor connection between scientific research and production

Science and technology is an important productive force. We need to pay attention to the fact that for scientific achievements in the state of knowledge to be transformed into a direct productive force, it needs to undergo a process of materialization. This process of materialization is realized through popularization and application of scientific achievements in the course of production. However, in China few scientific achievements are popularized or applied during production, they remain at the "sample, display item or gift" state. The result is a waste of manpower, capital and materials with no economic results. Statistics show that only 10 to 30 percent of the 3,000 or 4,000 important scientific achievements and advanced technology are being popularized and applied. GUANGMING RIBAO conducted a study on the utilization of the 245 technical inventions which had won national awards, and found that only 18.5 percent had achieved popularization and application. Thirty-six percent of the projects have not been used. Another 36 percent were merely used by the individual unit which invented them. Some of the inventions became dated before they had a chance to be used. There is the phenomenon of separating scientific research and production. A considerable number of the scientific units are responsible only for research work. The achievements from research are then turned over to production or planning units. The contacts between one unit and another are very poor. The cycle from research to utilization is too long, causing the economic results to be lowered substantially.

2. Unreasonable prices for new products

Price plays an important role in regulating the test, control, adoption and popularization of new technology. In China, the temporary price of a new product is set as the cost for its trial manufacture plus 5 to 10 percent profit. After the product is put into production, its cost decreases but the price usually does not, the temporary price becomes the fixed price. The pricing method of setting the price once is a deterrent to scientific and technical progress. When new product prices are set too low, there is no material incentive for innovation in production enterprises. When new products are priced too high, it naturally raises the initiative of production enterprises. However, the user units would refuse the new product because of low material benefit. Basically, this will hamper the adoption of new technology. Thus, accurate new product pricing practice is an important factor which affects the economic results of scientific and technical progress.

3. Enterprises lack the incentive and capacity for adopting new technology

For state-owned enterprises, there is a uniform production index. The evaluation of the work of an enterprise is basically based on the completion of the regulated production index. Under such circumstances, enterprises do not have the incentives needed to adopt new technology. To adopt new technology and to produce new products, new equipment, new techniques and training of personnel is needed. Not only the original production rhythm is disturbed, but due to the increase in production cost and decrease in output, profit retention and bonuses are affected. A number of enterprises prefer the security of customary production to the adoption of new technology or the popularization of new achievements. Furthermore, many enterprises lack the capacity for adopting new technology. Our current production plans are weak in adapting to changes for producing new products and adopting new technology. Enterprises lack the capital to popularize new scientific achievements. The supply of raw materials, equipment or semi-products are often delayed, hindering the popularization of new technology and the production of new products.

4. The pressure from the social labor force is great and the worker's technical competence is low

The large pressure from social labor force on the economic results of scientific and technical progress manifests in three ways. First, China has an abundant labor force and a great number of people are employed. The popularization and application of new technology and new achievements raises labor productivity, reduces the share of present labor, and increases the share of past labor. The total volume of labor in commodities becomes smaller. Consequently, the reduction in present labor is greater than the increase in past labor. In other words, scientific and technical progress induces the continuous rise of the organic composition of the enterprise and social capital, and conserves on labor and releases part of the labor force from production. Since there is a basic contradiction between labor and productivity and full employment, many enterprises are hesitant about adopting new technology and using perfected scientific achievements. Second, "cheap labor" also affects the popularization of new technology and new achievement by enterprises. Wages are low in China, and are

considered part of the production cost. The proportion of total wages in production cost is small. From the viewpoint of profit rate, it is more profitable to use manual labor than to substitute new machinery for labor. Third, the technical level of labor is low. With the retirement of old workers, about half of the current labor force were employed during the 10-year turmoil, the majority have an education level lower than junior middle school and have a long way to go before they can be trained to use new technology. Some of them do not have the technical competence to handle their current jobs.

In view of this, most scientific and technical achievements are not popularized and applied because "knowledge of the material" has not been incorporated into the social production cycle to become an important part of the practical social productive force.

The Key to Increase Economic Results of Scientific and Technical Progress Is To Accelerate the Popularization of Achievements

An important topic in the current reform of the economic front and the S&T front is to accelerate the popularization of scientific and technical achievements. The key to improving the economic results of scientific and technical progress is to speed up the popularization and application of scientific achievements. Estimates show that the utilization rate of scientific achievements in production is 10 to 30 percent, 70 to 90 percent are not being popularized and applied. The main reasons are: ideologically, scientific research is regarded as a hard mission and popularization is regarded as a soft mission; systematically speaking, scientific research and popularization are independent of each other, research organs are responsible for "invention," but not for "utilization." Enterprises and administrative departments are solely responsible for production, and have nothing to do with popularization. In award and promotion considerations, emphasis is placed on scientific achievements and academic papers. In fund and personnel allocation, popularization work is often elbowed out. In addition, many scientific and technical personnel regard laboratory research as "holding a golden baby," trial manufacturing of new products as "setting a milestone," but popularization as "doing a thankless task." To raise the economic results of scientific and technical progress and to promote social economic development, I think we should emphasize the work in the following three areas.

First, research and production units should make concerted efforts to popularize and apply scientific and technical achievements.

Scientific achievements are the fruits of the labor spent in exploring the unknown. However, if new knowledge is not applied and mastered, actual economic results will not be realized. The timely popularization and application of scientific achievements depends on two units: research departments, and production enterprises. Scientific departments should proceed from actual conditions and urgent needs in economic development to select topics in order to prevent the divorce of research from the production reality. In determining the direction of scientific research, we should consider both the level of advancement and the possible use of the research projects. Although advanced scientific achievements

may be achieved, because we lack conditions for comprehensive application in the area of production and scientific achievements are held up; or if the cost is too high, popularization is difficult. Scientific organizations should be responsible for both "invention" and "utilization." In particular, we should organize a force to develop new products and provide service to popularize new technical achievements. When the achievements of research units are transferred to production units, the research unit should give support and help the project along. This will accelerate the application of achievements. It is imperative that we select competent and enthusiastic and scientific and technic personnel to specialize in popularization work. We can learn from the experience of foreign countries where specialists with masters and Ph.D. degrees are engaged in popularization work. These people deserve the same treatment as scientific and technical personnel in performance evaluation. Production enterprise units must overcome the narrow-mindedness and habits of little producers, leaders at all levels must think about the long-term, correct management ideology, and emphasize popularization work. We can create the necessary material conditions and rational economic conditions for the application and popularization of achievements. Managerial departments should attach importance to market development work and make every effort to broaden and deepen the application of achievements so that the achievements can be used and used well.

Second, economic levers can be used to promote the popularization and application of scientific achievements.

In order to help enterprises to popularize scientific achievements enthusiastically, we should fully use the economic levers of price and tax, etc., to distribute in a rational manner the economic results gained from adopting new technology. As for price policy, we must carry out the principle of high price for high quality and low price for low quality. Out-of-date and low quality products should be penalized with low prices to promote technological development and product renovation. Large sums of capital are usually needed for popularizing new technical achievements; furthermore, the original sequence of production and the production management activities of enterprises are disrupted. If the added cost and incurred losses are to be born by the enterprises, it will undoubtedly affect the enthusiasm of the enterprises.

Concerning the reward system, I suggest that while increasing the amount of scientific research awards, we may consider paying only a certain portion of the award for research achievements which will not produce results in years. The remaining amount of the award will be recorded under the concerned personnel's names but will be temporarily withheld. When technical achievements are popularized and results can be seen, the balance will be paid in proportion to the economic results. Such a reward system encourages personnel in scientific research and technical development to be concerned about the popularization and application of their achievements, and to provide assistance to the popularization process. In tax policy, the tax exemption or reduction for new products implemented during the past 2 years has obtained definite results to promote technical progress. Our present endeavor is to further perfect the system and adopt comprehensive economic measures to support the popularization of new technology and new products. In short, we should provide material incentives and economic pressure to enable enterprises and scientific research departments to popularize achievements.

Third, reform the current management system to promote the popularization and application of scientific achievements.

A clear trend in current scientific and technical development is that scientific achievements have greatly accelerated technical changes, the cycle of "science--technology--production" is becoming increasingly short. Under the pressure of this situation, our scientific research management system should be reformed step by step and we should establish a management system which organically combines science, technology and production to help speed up the materialization process of scientific achievements. First, we should improve and perfect achievement management work. At present, the management of research achievements emphasizes the collation, compilation and report work. The more important work of large-scale organization, and the work to carry out the popularization and application of achievements is ignored. For those projects under popularization which affect many areas, organs that manage achievements should take the lead to organize scientific research, production, finance and basic construction departments to carry out the various measures and development, work together to solve funding and equipment problems, and mobilize the initiative of all parties to successfully popularize and apply achievements. Next, we should establish a unified system for planned production and scientific research. At present, the planning departments and scientific research departments are not coordinated. An integrated viewpoint of production planning and scientific research has not been formed, this affects scientific research and development, and the popularization and application of achievements. To correct this situation, we should adopt administrative measures by requiring that planning departments make known all the corresponding urgent scientific research mission to be accomplished when transmitting the annual production development plan. Scientific research department should carry out each concrete research project based on the needs of the production development plans, thus achieving some correspondence between production and scientific research and bringing vitality to the application of research achievements. The next step is to pay close attention to establishing various forms of coordinated scientific research and production and integrate the links of "scientific research-design-production-service" to form an industrial network that relies on scientific research. In Changzhou specializations to tackle key problems are being organized centered around new product development. In practice, the roles of scientists and technicians are brought into full play, and plant equipment is fully utilized to form a "coordinated process in which both scientific research and production are well-coordinated." The cycle from scientific research to production is shortened and scientific research expenditure is reduced. To change the present scientific research system which has a long history, we must start from the actual needs of scientific research and production and proceed to resolve the many pressing scientific research difficulties which have arisen during economic construction. Step by step, we can form a management system which will meet the needs of technological progress.

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TONG DALIN ON STRATEGIES FOR TECHNICAL REVOLUTION

HK160916 Beijing ZHONGGUO XINWEN SHE in Chinese 0218 GMT 16 Mar 84

["Tong Dalin [4547 1129 2651] Dwells on Two Priorities in the Strategy for the Technical Revolution"--ZHONGGUO XINWEN SHE headline]

[Text] Beijing, 16 Mar (ZHONGGUO XINWEN SHE)--Well-known Chinese economist Tong Dalin published in today's issue of JINGJI RIBAO an article entitled "In the Face of New Challenge," in which he says: Our ignorance concerning modern scientific knowledge and the links in our existing economic system that are unfavorable for technological progress are the two major difficulties for us in encountering this new challenge. Concentrating our forces to overcome these two major difficulties has become the major strategy to counter this challenge.

The article says that the rapid development of science and technology and the rise of the group of industries with sophisticated technology in our times is, in essence, a great race for "intellectual revolution" and intellectual development. An urgent task at present is to find a way to enable our laborers (both physical and mental) to relatively quickly learn modern scientific knowledge, continuously renew their knowledge, and thus train fine talented professionals of various kinds. At present, it is particularly necessary for us to train a large number of people for socialist enterprise who know science and are good at administration and management.

Tong Dalin now holds the post of vice minister of the State Commission for Restructuring the Economic System. He highly evaluates the newly-emerged "New Federation of Science, Education and Economy" and calls it a breakthrough in the existing economic system. He said: At present, in some of our cities and rural areas diverse forms of combinations of higher education institutes, scientific research institutes, and local economic and industrial sections have emerged. These new forms of combination can vigorously promote and push forward the comprehensive exploitation of intellectual resources and the rapid transformation of new scientific and technological achievements into new sections of industries. These combinations are also important bases for us in encountering the new challenge.

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MOVE TO INDEPENDENT TECHNOLOGICAL DESIGN PHASE ADVOCATED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI /SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY/ in Chinese No 10, 10 Oct 83 pp 18-20

/Article by Fan Chongliu /5400 1504 3461/ of the Harbin Industrial University: "China's Technology Should Enter a Stage of Completely Independent Design"/

/Text/ Overall, China's present technology is still in a stage of semi-independent design, and must consciously and rapidly move into a stage of completely independent design. This is a strategic question in the development of technology in China. We are currently formulating plans for scientific and technological development. In the plans, we should give full consideration to the question of this transition. Otherwise, this process of transformation will be sloppily continued over a long period.

1. China's Current Technology is in a Stage of Semi-Independent Design

Design work in technical departments in China can be broadly classified into the following four types of situation:

Type one--imitation of foreign products

Types two--partial imitation of foreign products, with a certain amount of improvement.

Type three-self-design, but with a lack of a reliable experimental foundation for basic design data, thereby leading to an inadequate understanding of the performance of devices. Experiments must wait until the devices are finished, sometimes to the extent that they must be formally put into operation for a period of time before it can be known whether or not they meet design requirements. This method of groping about in the dark frequently requires repeated redoing, which wastes time and energy. This is a fairly low form of independent designing.

Type four--self-design on the basis of fairly complete experiments, with determination of basic design data during experimentation. The designed devices are thus fairly well understood, and high-performance devices can be designed within a shorter period of time with less effort. This is a fully independent designing situation.

China's technical departments are unevenly developed in this aspect, with a predominance of type one and type two situations. Therefore, generally speaking China's technology currently is in a stage of semi-independent design.

The fully independent design we are speaking of here of course doesn't mean eliminating the absorption of foreign experience, but it is definitely not imitation.

2. We Must Move To a Stage of Fully Independent Design

After a nation gains political and economic independence, it must attain scientific and technological independence. Otherwise, strictly speaking, there cannot be full independence.

All countries which were formed after industry, science and technology have a problem of pursing developed nations. In this process, there is always imitation first, followed by independent designing by themselves.

Germany was a latecomer in western Europe. In the late 1870's, its industrial products were "cheap and shoddy," and for this reason its industry and technology imitated and ran after England. By the beginning of this century, Germany had a developed industry and technology, and its industrial products were world famous for their high quality.

Japan's industry developed later than Germany's. It imitated and pursued western Europe and America. Up to the beginning of World War II, Japan's industrial products were cheap and unattractive. After the Second World War ended, it underwent development in the 1960's and 1970's. Today, Japanese industrial goods have become a major threat to America and western Europe on world markets.

After over 30 years of effort, China has established a large-scale (in absolute numbers) industry, science and technology. We now have complete conditions to plan how to transform technical designing in China into a completely independent technical design stage.

We must see, however, that the greater the development of science and technology, the more difficult it is for latercomer nations to keep pace with developed nations. Japan's pursuit of America and western Europe was more difficult than when Germany pursued England. Now, it is even more difficult for us to catch up with America, the Soviet Union and other countries in science and technology. We must, on the one hand, have a spirit of marching forward courageously and despising everything, while on the other hand, we must thoroughly acknowledge the difficulty and complexity of this task.

3. A High-Level Experimental Base Is the Key

China's technological theory and calculation abilities are now low, but we lack a high-level experimental base. A high-level experimental base is the key to a transition to fully independent design.

Achieving fully independent design requires utilization of high-level experimental bases to determine basic design data. When designing new large-parameter devices (including high power, high voltage, high temperature, high atmospheric pressure, high speed, high vacuum, etc.), the original data, curves and calculation formulas are useless, and experiments to open up new channels are even more necessary.

In developed nations, all technological departments have a complete set of high-level experimental bases. For example, American aeronautical and space technology departments have several tens of large experimental bases, including wind tunnel laboratories (to determine the flight characteristics of aircraft and rocket bodies), high vacuum test-run stations (to determine the characteristics of jet engines under high-vacuum conditions), many types of materials laboratories, and other experimental bases. These types of experimental bases are necessary for independent high-quality design.

These experimental bases are enormous, complex and delicate syntheses. Besides the primary equipment, there must be many types of auxiliary equipment, measurement devices, specialized data management devices and computers, and so on. To be able to operate this type of experimental base, there must be a full complement of high-level specialized personnel, such as high-level experimental engineers, auxiliary staff members, high-level technicians, etc. A fairly long period of time is required between construction and full operation of experimental bases, and consequently, there must be guarantees of long-term stable working conditions.

These experimental bases are among the essence of modern science and technology, and are one of the most difficult points for latecoming countries wishing to catch up with developed nations.

In the past 30-plus years, China has established a fair number of experimental bases, but there are still a series of problems.

First: leaders haven't given them enough attention. We often only pay attention to concrete technical results, but ignore the major conditions which guarantee the results--experimental bases--and we haven't been able to take pains to use capital in this area.

Second: our knowledge of the complexity of modern experimental bases is insufficient. Sometimes, projects are hurriedly put into operation before the conditions are complete, which is an error of rash advance.

Third: attention has only been paid to primary facilities, while auxiliary equipment has been neglected, with a lack of an overall perspective. This has led to many experimental bases being incomplete for long periods. They cannot be fully operated, or can only be operated at a low level.

Fourth: we look down upon engineers. In modern science and technology, the division of labor between theoretical personnel and practical personnel is more and more obvious. This is determined by the complexity of modern science and technology. A person has limited energies, and cannot master both theory and

experiments. Marx and Engels said, "How far the productive forces of a nation are developed is shown most manifestly by the degree to which the division of labor has been carried." (Selected Works of Marx and Engels, Vol 1, People's Press, 1972, p 25.) The spirit of this statement is applicable to modern science and technology. China's present science and technology insufficiently understands this point, and the prejudiced emphasis on theory and the neglect of experiment must be corrected. This is one of the greatest obstacles to raising the level of experimental bases in China (and is also one of the major obstacles to the transition to a fully independent designing stage in our country's technology).

Fifth: the waste from rash action and repeated labor at a low level is frightening. I will provide an example. Electric power departments require laboratory models of trends in electric power systems for research on complex phenomena in electric power systems. This is a large scale, complex laboratory. For this reason, they have been constructed by the Ministry of Water Resources and Electric Power, by the Ministry of Machine Building, and by many universities with electric power specializations. At present, there are about 10 of these laboratories in China, but very few are actually capable of operation at a high level. Moreover, some units are making preparations for construction. In reality, three or four such laboratories would be sufficient if only they were well-run, rationally distributed by region, and opened to the outside. In America, some high-level laboratories operate 24 hours a day, and are open to the outside. We must increase efficiency.

Sixth: development is uneven. Some technical departments have fairly complete experimental bases, while some departments have serious shortages. For example, Meng Shaonong /1322 1421 6593/, the famous automotive scholar and chief engineer of the Second Automotive Manufacturing Plant said that, surprisingly, China doesn't have a single automotive testing ground in its entire automotive manufacturing sector.

The key to a complete technological transition to a fully independent designing stage is perfection of experimental bases in all areas.

A large amount of capital is required for perfecting a large group of experimental bases, and it involves economic planning. It is, therefore, a question of coordinating economic development with development of science and technology. There must be integrated plan formulation between the Planning Commission and the Scientific Commission. A small science and technology leadership group has been established in the State Council, which will make this matter easier to manage.

If we make a great effort to concentrate on this problem from now on, roughly 10 year's time will still be required to achieve the transition of technology to a stage of fully independent design. Therefore, we must definitely not just let things slide.

4. External Economic Activities Should Assist in Making China's Technology Independent

If we wish to make out country's technology completely independent, we must closely link up our external economic activities. All external economic activities, including bringing in foreign capital, importing equipment, importing technology, and so on, must promote the independent development of the economy and technology in this country. We definitely cannot pull the rug from under our own feet.

Currently, when certain departments need some specialized equipment, they don't trust trial manufacture by related technical departments in China, but would rather go abroad to order it. This is an erroneous method, and greatly obstructs the development of technology in China.

Some of the special equipment which has not been manufactured in the past by related departments in China should be produced on a trial basis. Of course, in comparison with products from experienced foreign manufacturers, such products will be somewhat poorer in quality and high in cost. However, if they can be used (attain a certain standard), then we should use domestic products. Otherwise, how can there be technological advances in China?

When importing advanced technology from abroad, it should be actively used, not merely copied. That is to say, the process of digestion and absorption should be speeded up. In addition, when importing technology, original trial production research work in this country should not stop, but should advance simultaneously. Of course, trial production research in China must rapidly absorb the good points of foreign technology.

In the past few years, China has carried out a policy of opening up to the outside, which is completely correct. Because certain cadres lack specialized knowledge, there are some defects in the system. A fair number of external economic activities exist in name but not in fact, with unsolveable problems. We should formulate appropriate policies and adopt proper measures to overcome this type of phenomenon.

At present, China has started a licensing system in the area of foreign trade, which is necessary. This alone, however, is not sufficient. There must be authoritative written standards for determining whether or not to issue licenses. For this reason, we feel that the National People's Congress should establish an "External Economic Activities Law" to play a role in protecting China's economy and technology. When drawing up this law, besides participation by legal scholars and economists, there should also be participation by people in the technical sphere and by workers in scientiology.

In order to protect its own national automotive industry, India does not permit the importation of foreign automobiles. Moreover, India did not have color television broadcasts before it was able to manufacture its own color television equipment. We, of course, should do even better than India.

12539
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ORGANIZING TRANSFER OF MILITARY TECHNOLOGY TO LOCAL ENTERPRISES

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI /SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY/ in Chinese No 10, 10 Oct 83 pp 31-32

/Article by Liu Wu /0491 2976/ of the Sichuan Provincial Science Commission: "How To Organize the Transfer of Military Technology to Local Enterprises"/

/Text/ The transfer of military technology to local enterprises is a major aspect of the transfer of military technology to civilian uses, and is also an effective way of rapidly raising the level of the technological foundation of local industries. For this reason, concentration on work to transfer military technology to local enterprises is an important task for local scientific commissions.

Organizing the transfer of military technology to local enterprises is complex work which affects a broad range of areas. Among them, there are many problems of technological and economic policies which can only be resolved on the basis of reforms in the economic system. Therefore, work to transfer military technology to local enterprises must first of all be carried out by selecting ways of least resistance. Its direction is to raise the level of the technological base of civilian industries by adopting new technologies, new materials, new crafts and advanced equipment which are already being utilized and matured by the national defense industrial system, to gradually replace backward technologies and equipment; and to train and bring up a large number of local scientific and technical personnel who are able to proficiently make use of these new technologies, new materilas, new crafts, and advanced equipment. The goal is to use the least amount of investments and the shortest period of time to obtain the greatest technical and economic results, and to bring product quality, product types and technical and economic standards of the primary local enterprises up to near or over advanced world levels.

Looking at the practice of transferring military technology to local enterprises in Sichuan Province, work to attain the above objectives should take the following aspects as its starting points:

1. Integrate the requirements of technological transformation in local enterprises, select and extend the achievements of military science and technology. During the past 30-plus years, in the process of developing military equipment, China has utilized new technologies, new materials, new crafts, and advanced

equipment. In the past, as a result of the mutual separation and lack of communication between military industries and local areas, many of the advanced scientific and technological achievements which originally could have been used in local enterprises were locked up inside the military industrial system, and were unable to fully play their proper role. The key point of transferring military technology to local enterprises is the inevitable extension of these achievements of military science and technology to local enterprises, by turning them into forces of production to promote the development of the national economy, thereby rapidly raising the level of the technological base of local enterprises. According to incomplete statistics, in the past few years military industrial units in Chongqing, Chengdu, Yibin, Neijiang, Jianglin, Wanxian, Jiangling, Nanchong, Daxian, and other places have supplied over 1,000 selected military scientific and technological achievements to local areas. It may be predicted that the development of production in local enterprises will be greatly promoted following the extension of these scientific and technological achievements.

Enterprises must center on the key points of technological transformation to select items for transfer. At present, they must urgently concentrate on being able to reduce consumption in enterprises, especially energy consumption; they must transform and renew their existing backward mechanical equipment; they must change the product structure, improve product quality and increase product types; they should develop raw materials that are in short supply; there should be comprehensive utilization, and other such projects. Examples are the nationwide extension of such military scientific and technological achievements in the past few years as lasers, far-infrared, electronic, photoelectric, thermal spray coating, organic silicon (and fluorine), and so on. Other technologies supplied by military industrial units in Sichuan Province such as fine stamping primary forming, ultrasonic wave nondestructive flaw detection, electrical heating vacuum, etc., all belong to this category.

Military industrial units should take the initiative and serve the technological transformation of local enterprises. Currently, many medium and small scale local enterprises have encountered problems of insufficient technical strength during their technological transformations. For example, the city of Yibin doesn't have a single high-level engineering technician, and there are only 300 or so engineers and technicians. Thus, during work for universal extension of military scientific and technological achievements, they have to organize technical forces from military industrial units to support and assist local enterprises in order to quickly transform these achievements into actual forces of production. The Nanguang Machinery Plant, for example, used advanced electrical heating vacuum technology to assist the Chengdu Thermos Bottle Plant in reforming the past backward techniques of using natural gas and coal gas for vacuum heating. The explosion rate dropped from 1.65 percent to 0.35 percent, and the first-time quality rate increased from 85 percent to 94 percent. In 1 year, thermos bottle production could increase by 100,000 units. At the same time, the Nanguang Machinery Plant trasformed, installed and debugged vacuum aluminum plating equipment in the Chengdu Mirror Plant. Mirror production costs dropped by 40 percent, about 700 to 1,000 kilograms of silver were saved in 1 year, and efficiency doubled over past levels.

In fact, military industrial units' service for technological transformation in local enterprises is also a form of transferring technology to local enterprises. Because military goods production is restricted by national defense tasks and moreover is unbalanced, regular tasks usually don't utilize full capacity. Thus, organizing military industrial units to serve transformation of technology in local enterprises is desirable and easy, whether for speeding up the transfer of military scientific and technical achievements to local enterprises, or for regulating the production tasks of military industries.

II. Multiple channels should be used for organizing the transfer of military technology to local enterprises. Impeded channels are a major factor influencing the transfer of military technology to local enterprises. Under present conditions, the method of "opening all channels, and multiple flows" aids in increasing the speed of transfers of military technology to local enterprises. In the past few years, in work to organize this aspect in Sichuan, apart from personal involvement by governmental leadership organizations and direct links between military industrial units and local factories and mines, the following forms have been adopted:

1. Organizing the transfer of military technology to local enterprises by means of various types of scientific and technological activities, scientific and technical service organizations, and mass science and technology groups. There are more opportunities for contact and understanding by both parties; this aids in having a definite object in view, and increases the success rate of transfers; it also assists in the centralization of all types of technical personnel in military industries to assist local areas in resolving technological problems. This year, for example, scientific and technological exchange conferences were held in Chengdu and Chongqing. Local military industrial units altogether exhibited 1,141 military science and technology achievements, and received bids for breakthrough projects from 87 local units. Through the exchange conferences, local areas learned about what technologies military industrial units could provide, and the military industrial units understood what technologies were needed by local areas, and which problems they could help local areas resolve.

2. Organizing the transfer of military technology to local enterprises through academic exchanges, technical advice and technical training. This actually was a form of transferring intelligence. According to incomplete statistics, 34 military industrial units participated in academic exchange activities concerning local industrial and agricultural production and civilian technology that were organized during the first half ot his year by the provincial Science Association. In scientific and technological exchange conferences organized by Chongqing city this year, all of the city's military industrial units provided technical advisory services. During the technical advisory services, the Jiangling Machinery and Equipment Plant assisted the Chongqing Storage Battery Plant and the Chongqing Rubber Industry Company in resolving key technical problems of automatic weighing and measuring. In the area of technical training, besides running training classes for local units and receiving personnel from local units for inplant practice and training, the military industrial units of Sichuan province, while developing various types of equipment for local factories and mines, expanded the "three guarantees" for services to the "five guarantees,"

adding guarantees for installation and testing, and for training of operating and repair personnel. Practice has proven that this form of transferring knowledge can accelerate the pace of transferring military technology to local enterprises and increase the technical strengths of local enterprises.

3. With military industrial units as the center, organizing local medium and small enterprises to establish coalitions for coordinated manufacture of complete sets of products. By means of these coalitions, the economic results of military industries and local areas are closely integrated. Military industrial units are thereby not restricted by departmental or local ownership systems, and can provide fixed, long-term assistance to local medium and small enterprises in the areas of technology, equipment, personnel, and so on. In this way, the level of the technological foundation of local enterprises can be raised in a stable manner.

III. There should be good work for overall equilibrium and organized coordination. This requires unified management of the transfer of military technology to local enterprises by specialized organizations or departments. The tasks are to study and resolve problems of economic policies encountered during the transfer of military technology to local enterprises; to centralize specific capital to assist local medium and small enterprises to bring in military industrial technology; to work jointly with related departments to select a group of military scientific and technological achievements relevant to current economic development to serve as key items for extension; and, to arrange for military industrial units to undertake civilian scientific research topics to assist local enterprises in carrying out technological transformation. This will lead to unimpeded channels for the transfer of military technology to civilian uses.

12539
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APPLICATION OF MILITARY TECHNOLOGY TO CIVILIAN ECONOMY ADVOCATED

Shenyang LIAONING RIBAO in Chinese 16 Sep 83 p 2

[Article by Yang Jianzhang [2799 1696 4545]: "We Must Pay Better Attention to Military Technology Transfer"]

[Text] The war industry departments in our province have abundant technical resources and equipment and a certain amount of technical reserves. To implement the guiding principle of "uniting the army and the people," these departments have been exploring ways to transfer military technology to civilian use and have come up with some delightful results. Five forms of military technology transfer are currently in existence in our province.

1. Using surplus capacity to produce civilian commodities. Many military enterprises have readjusted their production setup, cleared out their factory buildings and removed their equipment to make room for newly established production lines for civilian commodities. These enterprises have supplied the market with hundreds of varieties of light-industrial commodities and produced large quantities of spare parts for factories, mines and other enterprises.

2. Implementing military science and technology [S&T] transfer. Since the 3d Plenary Session of the 11th CPC Central Committee, more than 50 types of technology have been transferred from the defense industry system to civilian uses in our province.

3. Contracting to undertake scientific research tasks or cooperating with civilian departments to tackle key problems. A number of war industry factories in our province have cooperated with mining, chemical engineering and construction engineering departments to tackle key research problems and have successfully manufactured mining explosives, relay-detonation blasting caps, preservatives and the like. These products help to improve labor conditions and enhance safety in mine blasting.

4. Providing technical information and services for civilian enterprises. Some military industrial enterprises have made full use of their technical personnel and testing procedures, actively provided technical information and services and solved many difficult problems for civilian departments.

5. Participating in S&T interchange activities to expand the use of new technology. Military technology transfer has not only achieved tangible economic benefits but also has enhanced the development of S&T, enabling military industrial enterprises to begin to integrate military and civilian needs.

Three problems require study and resolution before military technology transfer can be perfected.

1. Raising our level of understanding and strengthening leadership. Military technology transfer is definitely not just an expedient to solve the military industry's "lack of enough to eat" problem during the period of readjustment. It is an important peacetime measure and a basic and long-term national S&T policy through which military industrial departments can contribute to and serve economic construction. Concerned departments should give more effective leadership by constantly summing up past experience and exploring various effective forms of cooperation. Policies and regulations encouraging military technology transfer should be drawn up soon, so that full impetus can be given to the continuous development of technology transfer.

2. Unified over-all planning and stressing main points. Emphasis should be placed on transferring new technology. Military industry and civilian departments should strive to cooperate, organize specialists to initiate investigation and research and, on the basis of such studies, draw up plans for technology transfer, so that new techniques, equipment and technology can be used in economic construction. In producing commodities, military industrial enterprises should not compete with civilian factories by producing those "hot items" currently on the market. Rather, they should make the best use of the strong points of their personnel and their specialized technical know-how to invent and manufacture those top-grade, high-precision and new-technology products which are badly needed by society, represent developmental direction and can meet export demand.

3. Proper handling of the relationship between exchange and secrecy. Security in S&T is mainly aimed toward foriegn countries; domestically, security is aimed at preventing leakage of secrets abroad. Between military and civilian industries, only cooperation and interchange should be advocated. The military's industry research and production departments should rationally and quickly set the degree of secrecy for each classified S&T item. Those items which should be declassified must be declassified; those whose degree of secrecy should be reduced must be so treated. Measures should be adopted to expand application of declassified items. Never should security be used as an excuse for blocking technology transfer.

12453
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TECHNICAL PROGRESS, IMPORT OF TECHNOLOGY DISCUSSED

Beijing JINGJI RIBAO in Chinese 12 Sep 83 p 2

[Article by Zhu Rongji [2612 6954 1015], vice minister of the State Economic Commission: "On Technical Progress and the Import of Technology"]

[Text] In order to push forward the work of the 3,000 advanced technological import projects, the State Economic Commission and the Ministry of Foreign Economic Relations and Trade jointly sponsored a study class for importing technology to transform existing enterprises. Zhang Jingfu [1728 0513 1133], member of the State Council and chairman of the State Economic Commission, delivered an important speech entitled "Open Up a New Situation in Importing Technology To Transform Existing Enterprises" at the opening session. The study class invited some famous Chinese and foreign experts to give lectures. Folowing are excerpts of the concluding speech given by Zhu Rongji, vice chairman of the State Economic Commission.

The Prerequisite to Realizing the Strategic Goal of Economic Revival is To Continuously Raise Economic Results.

The general goal of our country's economic construction proposed at the 12th Party Congress is, while steadily working for more and better economic results, quadruple the gross annual value of industrial and agricultural output by the end of this century. This is a correct policy that was formulated after summing up the experience and lessons in socialist construction over some 30 years. Historically, we once onesidedly pursued high speed at the expense of economic results and paid an extremely high price for doing so. In order to pursue high speed, we launched capital construction projects on a very large scale. An equilibrium could not be maintained in raw materials. There was shortages in heavy industrial production, especially in energy and transport. Light industry and the market were both affected. Product quality and variety and enterprise quality failed to progress. These problems basically are still unresolved. Central leadership comrades told us recently that we must do a good job in quadrupling output value and not mess up. I believe that quadrupling must be launched under the prerequisite of continuously raising economic results and that speed must be subordinate to results.

We Must Place Economic Work on the Path to Technical Progress.

In order to raise economic results, we must place economic work on the path of technical progress. At the national scientific and technological [S&T] commendation rally last year, Premier Zhao Ziyang pointed out that the guiding thinking in economic construction is that, "in order to modernize, revive the economy and quadruple output value, we must rely on S&T progress." Premier Zhao also once clearly pointed out that one-half of that quadrupling must come from technical progress.

The role of technical progress in promoting economic growth may be summarized in four main areas: raising the quality of the labor force; improving production techniques; raising the technological level of equipment; and improving the quality of management. Some comrades have already applied different methods of calculation (for instance the production function model) to measure the influence of technical progress on production growth and conclude that in the last 30 years less than 20 percent of the growth of our country's gross industrial output value derived from technical progress. This falls far short of the demand that "one-half of all growth come from technical progress." Yet, among major industrial nations, the proportion of growth that derived from technical progress rose from 5 to 20 percent at the turn of the century to 60 to 80 percent by the 1970's. Herein lies a message that we should mull carefully as we formulate our strategy for socialist modernization.

The world has undergone three industrial revolutions all of which stemmed from new scientific discoveries and technical progress and led to the rise of new industries and changes in the economic structure. The first industrial revolution began at the end of the 18th century and was based on the mechanization of pig-iron smelting and the cotton textile industry, which emerged from England. The second industrial revolution began in the mid-1840's and was the period of the steam engine, the railroad and Bessemer steel. The third industrial revolution took place around the turn of this century and began with the development of electricity, chemicals and the automobile. People predict that the fourth industrial revolution will soon arrive (some hold that this revolution had already begun by the late 1970's). The focus of this new age will be the microprocessor, laser technology, genetic engineering, new-type materials and new-energy development. The previous revolutions each took 50 years to run their courses. The course of next revolution may be shortened, and economic development may be extremely astounding. We are faced with a challenge on a world scale.

We should not forget that in the mid-1950's, our country's economic situation and technical level were not inferior to Japan's; that the gap was still small in the mid-1960's; but that during the following 10 years, we ignored the "direct productive forces" of S&T and lost time, while Japan "was built with technology" and rapidly became an economically large nation. This lesson is profound. The next 20 years will be the age in which we strive to catch up, and we must not slacken our efforts in technical progress again.

The Focus of Technical Progress Is To Raise Quality and Lower Consumption of Raw Materials and Energy

The issue of quality (in a certain sense, variety is also quality) is related to the survival of an enterprise and the wealth and strength of a nation and provides the best means of streamlining the national economy. This principle is of course quite obvious. However, for reasons related to our economic system and our policy, quality has never been stressed and given the attention it deserves.

The primary weakness in the present system is the lack of vitality. There is no competition among enterprises, and enterprises lack proper initiative and flexibility. Furthermore, in planning and management, we do not attach importance to quality evaluation standards and lack an effective system of quality control. In terms of price policy, we lack flexible economic measures to allow higher prices for good quality and lower prices for lower quality. In credit policy, we do not sufficiently offer favorable terms to encourage enterprises to raise quality and increase variety. Thus, in spite of the fact that we have long promoted comprehensive quality control in enterprises, we have not made any decisive progress in the problem of quality.

Improving quality increases use value and achieves the most socioeconomic benefits at the least cost to society. There are two tire factories with an annual output of 1 million tires each. The tires produced by one factory last on the average 20,000 kilometers, while the tires produced by the other last 40,000 kilometers. In accordance with the evaluation standards of the present plan, as long as other factors are similar, the two factories can obtain the same economic rewards. However, their respective contributions to society are definitely not only a matter of a 1:2 ratio, for the production of one tire consumes much precious rubber, carbon black, fuel and electricity. How can this encourage technical progress? If we cannot change from the current, popular predilection for "winning victory through quantity" to the realistic practice of "winning victory through quality," then we cannot escape our backward technical state and become a modernized and strong nation.

Reducing the per-unit consumption of raw materials and fuel power in production is an urgent economic task and offers the greatest potential for industrial enterprises. Lowering consumption is almost synonymous to lowering cost. This is because, currently over 80 percent of industrial production costs derives from material consumption. Our industrial enterprises have very high per-unit material consumption rates, which rates not only are vastly inferior to advanced international levels, but often fall short of their own best levels. To resolve this problem, we rely on technical progress. In our country, the primary goal of technical progress is not to save manpower but to lower consumption, which means saving raw materials and energy.

With the implementation of the policy of opening to the outside world economically, the connection between the market at home and the market abroad, the arrival of the global industrial revolution, the improvement in

international economic and technological levels, and the deepening of the reform of the domestic economic system, our country's industry faces a serious challenge and our enterprises face a change toward raising quality. The days in which enterprises rely on low wage bills and value transfers through cheap raw materials are basically over. The development of the economic situation at home and abroad will force enterprises to raise their own quality in order to survive and develop. In a capitalist country, with each economic crisis, one group of enterprises will collapse while another group will move one step up and raise the technological level by one grade. Enterprise managers of our country must have ambition, cast off the crutch of "eating out of the same big pot" and, through socialist competition and their hard-won technical progress, render proper contributions to the four modernizations. Reform of all our economic policies and system must center on this requirement and fully promote and encourage technical progress.

Three Policies Concerning Technological Improvement Work

Technological improvement work includes many links. We must make overall arrangements for and treat that work as an integrated process, which basically means to take the product as the head and technology as the basis and undertake, in an integrated and coordinated manner, all such links as key technological work, trial manufacture of new products, adoption of new technology, import and absorption of foreign technology, popularization and transfer of the new domestic technology, technological transformation of enterprises, full production of new products, as well as such factors as standards, measures, patents, information, consultation and training. These links must be fit together in the plan so as to form a comprehensive production capacity and give play to economic results.

These links can basically be summarized under three policies: skilled-personnel development, technology selection and technology transfer.

Skilled-personnel development is the basis of technical progress. In our country, higher education is not widespread, vocational education is not developed. In terms of quantity, quality and the structure of skilled personnel, our present S&T and economic management personnel cannot meet the needs of modernization. To basically solve the problem of skilled personnel, we need the effort of several generations of people. At present, we must carefully study "The Selected Works of Deng Xiaoping" and raise cadres' and the masses' understanding of the importance of knowledge, education, and S&T. We must conscientiously implement the policy toward intellectuals, give full play to the socialist enthusiasm of existing skilled personnel and formulate new policies to bring in additional skilled personnel. Skilled-personnel development requires investment. But the economic results of intellectual investment are much higher than those of fixed-capital investments. Departments and localities must try their best to tap all potential in order to strengthen investment in intellectual development. Some localities have the money to engage in redundant construction projects and set up small cigarette factories but are stingy about investing in the development of skilled personnel. This is a lack of foresight.

Technology selection determines the direction of technical progress. Premier Zhao Ziyang clearly asked us to "form a technical system that embodies our country's distinctive characteristics." The various departments and sectors should act in accordance with this general demand and, in combination with their own characteristics and proceeding from reality, formulate their own stable technical and equipment policies. The selection of technology must use this as the basis in choosing to meet or surpass targets in technological improvement, in deciding whether to develop our own new technology or to import technology from abroad, in choosing to import software or hardware technology, and in choosing the criteria for assessing the technological levels and economic results of projects.

Technology transfer determines the breadth and depth of technical progress and primarily refers to policies regarding the modes (transfer or popularization) by which the results produced through domestic S&T development and through absorption of imported technology are transferred to different sectors, regions and economic strata. To a certain extent, the technology transfer is determined by the technology selection. If the direction of the latter is correct, the rate of technology transfer will be high and technical progress will be accelerated.

The Import of Suitable Advanced Technology is a Shortcut in Promoting Technical Progress.

In order to realize the party's strategic goal, we must have our feet firmly planted in self-reliance, rely primarily on our existing technological and material basis and strengthen our own forces in scientific research, designing, and technology in order to solve the problems which we can handle ourselves. However, in order to speed up technical progress and strengthen our capacity for self-reliance, we must attach great importance to importing advanced technology from abroad, since this is a shortcut in promoting our country's technical progress. After conducting investigation, research and unified planning, we must adopt a variety of means to import, absorb and convert into our own all the production technology we urgently need but cannot ourselves immediately provide. This way, we can stride across the temporal gap formed by history. If we insist on doing everything ourselves, we will usually cause delays and miss opportunities. This is not worthwhile, and no advanced industrial nations do this.

Since the nation's founding, we have scored achievements in the work of importing technology. But in the past, we onesidedly emphasized the import of complete sets of equipment and lacked experience in importing technology to transform existing enterprises. Thus, we have not made any breakthroughs.

The leading comrades of the CPC Central Committee and the State Council have been extremely concerned about importing technology to transform existing enterprises, particularly medium-sized and small enterprises; instructed us on many occasions "to engage in tens of thousands of projects;" and asked that we "appropriately liberalize our policies, grant a proper amount of review and approval authority to lower levels and strive to simplify

procedures." The State Council has adopted two major measures to stimulate technology imports. First, it formulated a plan for 3,000 advanced technological import projects in the final 3 years of the Sixth 5-Year Plan in order to strengthen the technological transformation of existing enterprises, especially medium-sized and small enterprises. This is an important step in promoting the technological improvement of industrial and communications enterprises, in improving comprehensive economic results and in establishing a good foundation for the development of the national economy during the Seventh 5-Year Plan. Second , in March of this year, the State Council separately approved pilot projects granting Shanghai and Tianjin extended authority in importing technology to transform medium-sized and small enterprises. We are beginning to see the results now, and the import of technology has advanced one big step. We must carefully study the experiences of Shanghai and Tianjin in order to promote the import of technology in other localities throughout the country.

Conscientiously Sum Up Experience, Do a Good Job of Importing Technology In Order To Transform Existing Enterprises

In light of the preliminary practice of Shanghai and Tianjin, the pilot cities with expanded authority, and the experiences of other localities, we must pay attention to the following problems in the work of importing technology.

1. The plan for importing technology must be integrated with the plan for the technological transformation of each sector and must accord with the state's technical and equipment policies. Our country is very large. Everyone is enthusiastically carrying out the four modernizations. If we do not have a multilevel plan for importing technology, or if we separate this plan from that for the technological transformation of each sector and engage instead in "two separate matters" then things will not turn out as we had hoped, fail due to the lack of funds or other factors or clash with each other, causing redundancy and waste. To carry out this work, we must keep in mind the entire situation, adhere to each sector's arrangements and strengthen coordination throughout the country. To import technology, we must proceed from the weak links of each sector, determine the gaps between domestic and foreign technology, then carry out work accordingly, step by step and selectively. The mechanical and electronics sectors must take the product as the head of the process, focus on saving energy and give prominence to basic parts, component parts and energy-efficient equipment that is produced in large volume and has extensive uses. The light and textile industries must give prominence to quality and variety. The raw materials industry must pay special attention to technical innovation, comprehensive utilization and lowering of consumption.

2. In importing technology, we must attach importance to software and must not simply import equipment. Importing software generally refers to the purchase of patented instructions, blueprints, computer programs, technical criteria, state-of-the-art technology, technical demonstrations and technical guidance in design, technology, manufacturing, installation, debugging, examination, maintenance and management. It also includes the introduction

of new skilled personnel and technical training. Importing hardware refers to the purchase of electromechanical equipment, special-purpose equipment and special structures. Some comrades do not differentiate between importing technology and importing equipment. This is improper. Of course, the import of advanced equipment and single machines that embody patented inventions and state-of-the-art software creates a new technological configuration and can bring about change in production technology, raise economic results and attain the purpose of importing technology. Proceeding from the present situation at home, in order to win time and speed up technological improvement, we also need to import some equipment which we cannot domestically manufacture immediately or well. But in terms of guiding thinking, we must emphasize the import of software and gradually let the import of software technology occupy an important position. Only in this way can we, by spending little money, obtain fast results, change the technological appearance of enterprises and strengthen the ability of our country to develop new technology independently. Japan has attached great importance to software imports, which currently number about 2,000 types each year with a value of nearly 1 billion U.S. dollars. We should draw lessons from this experience. At present, we must conscientiously sum up our good experiences, strengthen the integration of industry and trade and of technology and trade, utilize flexible modes (such as cooperative production and joint ventures) and at the same time strengthen foreign affairs work, so as to enable foreign businessmen to understand that our country has a very large market and that there are very bright prospects for cooperation. Our country is about to promulgate a patent law and will respect the conventions of international technological transfer and let foreign businessmen obtain proper benefits. Through this arduous and meticulous work, we can open up a new situation in importing technology.

3. Conscientiously complete preparatory work for technological import projects. The plan to import 3,000 types of advanced technology is an important task. Although the projects involved are not large in scale, the work of transforming old factories is very complex, and much technological preparation is required. The various departments, districts and enterprises must do a good job in this preparatory work, mobilize experts in various fields to take part in plan review and project assessment, and complete good technological and economic analyses and feasibility studies. Selected points for importing technology must be established, using those units whose leaderships have undergone rectification, that have a good foundation of production technology and business management, that can absorb technology and that possess the qualifications to engage in foreign affairs work. As for those projects that do not possess such qualifications and whose preparations have not been completed, we must temporarily postpone their arrangements and, in particular, must not launch foreign affairs work without the approval of the departments in charge, so that such projects will not be bungled and thereby affect our country's international reputation.

9335
CSO: 4008/20

PAYMENT FOR USING TECHNOLOGY TRANSFER DISCUSSED

Chengdu SICHUAN RIBAO in Chinese 15 Sep 83 p 2

[Article by Zhao Ze [6392 3419]: "Some Views on Payment for Technology Transfer"]

[Text] One form and path for expanding technological achievement is to practice payment for using technology transfers. Lacking a patent system, various localities are implementing on a trial basis the method of payment for using technology transfer in order to protect ownership rights to technological inventions. However, since no laws or concrete methods have been established on national or provincial levels, technology transfers are negotiated in a voluntary manner between research and production units. Therefore, many problems do come up, since there is no uniform guiding ideology or fee standard, and the systems of economic and technical responsibility of the two sides do not mesh. The technical and economic disputes that arise during implementation of transfer agreements have proved especially difficult to arbitrate, thus hindering the normal development of the system of payment for using technical transfer.

To solve the aforementioned problems, we propose the following measures:

1. To expand technological achievement, compensation has to be made for use of inventions. Technical inventions are a valuable form of society's wealth, and when applied to production, may engender various kinds of economic, technical and social benefits. Thus, during exchange, compensation commensurate to the value of this technology should be rendered. The old indiscriminate transfer of resources and "eating from the same big pot" are destructive to modernized social production and exchange. It is difficult to spread technology by administrative methods alone. Only through economic methods, by paying for the use of technology transfer, can technology spread and become widely used.

2. Taking as a basis national conditions and considering the current reforms of the scientific research and economic systems, we should establish regulations concerning payment for using technology transfers, clarify management of such payment, settle the details of implementation and solve some of the problems involved in transfers.

3. During the process of technology transfer, scientific research units and colleges and universities must firmly establish the notion that science and technology should serve economic construction. When choosing research topics, one must proceed from practicality and be attentive to the economic results of technological inventions. During technology transfers, one must bear cardinal principles in mind, take the overall situation into account, follow the principle of contributing as much as one can to economic construction and adhere to the principle of keeping fee charges down. In setting standards for transfer fees, we should consider the following factors: the actual costs of experimentation and research; more importantly, the economic benefits produced through dissemination of the technology; and that transfers should be voluntarily agreed upon and be mutually beneficial. Technologies which are significant to the national economy and to the people's livelihood should be extended by the state through compulsory administrative methods and are not suitable for payment transfers.

4. To initiate a technology transfer for payment, the research unit and the user unit must first sign a contract. During the process of the technology transfer, the research unit should conscientiously give technical guidance and provide technical data and services to ensure that the transfer leads to increased productivity.

12453
CSO: 4008/47

STUDY SESSION ON IMPORTING TECHNOLOGY FOR ENTERPRISE TRANSFORMATION HELD

Beijing JINGJI RIBAO in Chinese 24 Aug 83 p 1

[Article by Zhang Chaoyang [1728 2600 7122]: "State Economic Commission and Ministry of Foreign Economic Relations and Trade Hold Study Session on Importing Technology for Transformation of Existing Enterprises; Zhang Jingfu [1728 0513 1133] Outlines Several Requirements during Talk at Session"]

[Text] In order to properly and concretely accomplish the work of importing 3,000 items of advanced technology, the State Economic Commission and Ministry of Foreign Economic Relations and Trade jointly held a study session in Beijing 19-23 August on importing technology for the transformation of existing enterprises.

Participating in the study session were 200 cadres responsible for technology importing work from various departments of the State Council, economic commissions of various provinces, municipalities, and autonomous regions, and import and export commissions.

The opening ceremony was attended by Tian Jiyun, vice premier of the State Council; Zhang Jingfu, state councilor and minister of the State Economic Commission; State Councilor Wang Bingqian; Du Xingyuan, member and secretary-general of the Central Finance and Economic Leading Group; and responsible persons of related departments of the State Council.

The opening ceremony was chaired by Lu Dong, vice minister of the State Economic Commission. Zhang Jingfu gave a talk entitled "Developing a New Situation of Importing Technology for the Transformation of Existing Enterprises." He said that the leading comrades of the CPC Central Committee and the State Council consider the work of importing technology for the transformation of existing enterprises (especially medium and small enterprises) as being extremely important. This work is a quick way of pushing forward our country's technological progress. In order to accelerate the rate of technological progress and increase our capability for self-reliance, various areas and departments must adopt an activist attitude; and, on the foundation of investigative studies and unified planning, many ways should be adopted to import on a timely basis production technology which is urgently needed but which cannot immediatley be developed domestically.

Zhang Jingfu outlined the following concrete requirements on importing technology for the transformation of existing enterprises:

1. The planning for the import of technology must be closely united with the planning for technological transformation of each sector, must not be treated on a piecemeal basis and, above all, must not be separated from planning for technological transformation, which otherwise would result in "two pieces of skin." We must discover the weak links and technological gaps of each sector and proceed accordingly on a step by step basis and with priorities.

2. Software imports must be stressed and given special support so that they gradually occupy an important position.

3. Preparatory work for technological imports must be conscientiously carried out. When determining import strategy, we must select units whose leading groups have been reorganized, whose production technology and managements are good and who have all the required conditions.

Representatives from Shanghai and Tianjin participating in the study session made presentations. Well-known specialists from within the country and abroad gave lectures on questions related to importing technology for the transformation of existing enterprises.

5974
CSO: 4008/2

FEASIBILITY STUDIES KEY TO IMPORTING TECHNOLOGY, EQUIPMENT

Shijiazhuang HEBEI RIBAO in Chinese 12 Aug 83 p 4

[Article by Wang Jiazhen [3769 1367 3791]: "Feasibility Studies Are the Key to Importing Technology and Equipment"]

[Text] In step with China's policy of opening up to the world, there is a positive, ever-increasing trend toward importing advanced foreign technology and equipment. Thus, emphasis on feasibility studies on such imports is showing its importance more and more.

These studies take place before the importing of advanced technology and key equipment. They include thorough investigation, calculation and analysis: careful investigation of how the technology or equipment measures up to international standards; calculation of the results that it can produce for the development of China's national economy; and analysis of the technical need for it in China and of how it can fit in with other equipment here.... Only then does China choose the optimum plan and place its order. In this way, the process of feasibility studies is one of repeated investigation and analysis, the screening of many plans, and then selection.

How is the quality of feasibility studies directly related to the success or failure of an imported item? Here are two ready examples.

In 1980, the Huaibei Pharmaceutical Factory decided to import some key equipment in order to transform screening, protein separation and amylum refining, three backward links that were affecting amylum's quantity and quality. Thereupon it quickly transferred seven technicians to do broad and detailed investigation and comparison of the production and technical standards of similar products made abroad and in China. It subsequently decided to spend foreign exchange to import such key equipment and prototypes as amylum centrifuges, crooked screening machines and degritting machines. At the same time, the factory itself manufactured several complete sets of that equipment. The results of the importing were as follows: the amount of amylum handled daily by the factory and its rate of recovery rose markedly while the protein content and the level of raw and processed material powder in the amylum end product declined somewhat. After the transformed equipment had operated for only 9 months, the saving in corn and the increased output of glucose alone amounted to a recovery of 60 percent of

total investment. The importing of this equipment achieved results in the form of low investment, quick effectiveness and good economic results. The major reason for this was the thorough feasibility studies, done in advance, that supplied accurate and reliable data for the decision to buy this equipment.

Here is the second example. Shijiazhuang's electrical machinery plant spent several hundred thousand dollars in foreign exchange to import a set of automatic xiaxian [coilers 0007 4775] equipment from Japan in 1979. Its xiaxian capacity that year was 230,000 tai [0669], which may be said to match advanced international standards. Because the necessary feasibility studies did not precede the importing, however, the imported equipment's production capacity did not complement that of the other processes of the plant's electrical machinery. Instead, it was far different from the production assignment given to the plant by higher authorities. The plant's annual assignment for the products made by the imported equipment was equivalent to a mere 10 percent of that equipment's capacity. For more than 10 months out of the year the xiaxian [0007 4775] equipment had to lie idle while the other processes had only one-third of its production capacity. Importing equipment to complement it would cost several hundred thousand dollars more. In addition, the plant's assigned output would still be far less.

It is not hard to see from these two examples that the key to properly importing technology and equipment is careful feasibility studies. The important things that must be stressed in these studies are the following:

First, we must be clear on whether the item to be imported is advanced and feasible. We have to organize complete investigation and research by scientific and technical personnel. They must not only analyze the actual conditions in the region, industry and plant but must also study the item's technical standards, as compared to the world's and China's, in order to ascertain how advanced they are. More than consultation of large amounts of relevant material is necessary, because some items must be examined on the spot abroad. Examination must include comparison before the applicable technology is selected and the optimum plan decided upon.

Second, we must be clear on whether we have the prerequisites in production and construction. This means knowing full well that the item to be imported will have what it needs in raw and processed materials, fuel, power, communications, transport and complementary equipment. If this involves problems with the utilization of natural resources, we must examine its practicability as regards relevant conditions in the mines, oil fields, waters and forests. Then the use of the item will be established on a firm and reliable foundation, and economic results will appear as quickly as possible.

Third, we must be clear on whether the item to be imported is of economic benefit to us. This perforce means ascertaining how well that technology's or equipment's finished and semifinished articles do in the international and domestic markets, i.e., in terms of production costs, prices, sales,

amounts of investment, production scales and so forth. Accountants must calculate construction investment, profit from investment, return on investment and loan repayment. Once these are determined, we can ensure that our importing is in step with the creation of complementary conditions so that we will be less blind.

We should mention a fourth point, namely, that conscientious evaluation of feasibility study reports is necessary for guaranteeing the quality of feasibility studies. This work should have a practical organizational guarantee and the participation of the units in charge of managing the national economy. Moreover, specialized technicians should be invited to provide comprehensive evaluations and approvals as a team. In this process they must obey pertinent principles and procedures by rigorously examining the sources and reliability of every item of data in the feasibility study reports. Technological and economic rationality, as well as the fundamental complementary relationships between the item to be imported and raw materials, power, communications, transport, natural resources and so on, unify the plans for the item with the overall program of state and locality. Thus imported technology and equipment will surely be able to improve economic results rapidly and better.

12465
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IMPORT OF TECHNOLOGY DISCUSSED

Beijing JINGJI RIBAO in Chinese 29 Jul 83 p 2

[Article by Yang Dehua [2799 1795 5478] and Liang Yibin [2733 3085 3453]: "Open Up a New Situation for the Import of Technology--an Interview with Zhu Rongji [2612 3579 1015], Vice Minister of the State Economic Commission"]

[Text] The news that our country will import 3,000 types of advanced technology has aroused the attention of people in the economic circle and of the broad masses of readers. Thus these reporters conducted an interveiw with Comrade Zhu Rongji, vice minister of the State Economic Commission.

When we asked Zhu Rongji for a report on the progress of the 3,000 advanced technological import projects, he said in a well-thought-out manner: "I can offer some news which perhaps is not news anymore."

"Everyone knows that Comrade Xiaoping once instructed us that we must launch tens of thousands of projects to import technology and transform medium-sized and small enterprises. In May of last year, the leading comrades of the State Council issued a directive asking the State Economic Commission to take the lead in emphasizing this matter. Since that time, the State Economic Comission, together with concerned departments, has formulated a plan for importing 3,000 types of advanced technology in the future. In each of the first 3 years following the implementation of the economic policy of opening to the outside world, we concluded only several tens of agreements to use foreign exchange to import technology to transform existing enterprises. Last year, we concluded several hundreds of these transactions, and this year we will conclude several hundreds more. Next year, we expect to handle over a thousand of them. This is a very arduous task. But this is an important step in promoting the technological progress of enterprises, raising overall economic results and establishing a foundation for economic development during the Seventh 5-Year Plan. And the task is also a major means by which to take advantage of the favorable opportunity, provided by the economic recession of the West, to open up a new situation for the import of technology. 'The 3,000 projects' constitute a complex plan that cannot possibly be accomplished in one move. The method we have adopted is called rolling forward. We will undertake projects one group at a time. When one group matures, we will approve another and import a third. Recently, we approved 103 technological import and transformation projects in cooperation

with some European countries. At present, the Ministry of Economic Affairs and Foreign Trade is organizing foreign affairs work, and the various responsible departments are racing to compile feasibility study reports in an effort to sign contracts and conclude transactions within this year. These projects will be imported separately from the EEC, France, Belgium, England and Austria." Following this, Zhu also introduced to us the situation in Shanghai and Tianjin, the two pilot cities that have expanded authority in technological import. Comrade Li Ruihuan of Tianjin Municipality visited Europe and signed on one occasion 45 technological import agreements on projects for which all prior preparatory work had been completed. Europeans praised the delegation's unexpectedly high work efficiency. "Shanghai is making extremely rapid progress," said Zhu, as he handed us a few reports. "Shanghai Municipality has specially set up a leading group in charge of technological import work. This group has compiled import progress charts; established a system of responsibility; designated project bureau chiefs, project managers and project factory heads; and organized a project examination network in which industrial and foreign-trade departments, the People's Bank, the Bank of China and the Construction Bank jointly participate. The group has reformed the import system. Under unified and organized leadership, the group permits several companies to "trade in five ports" and opens up many channels for foreign affairs work. To date, the group has signed contracts for 65 projects, and it is estimated that it will conclude over 200 transactions within this year."

Without waiting for more questions, Zhu Rongji quoted copiously from many sources and talked on and on about the meaning of technology import. He held that, in order for an economically backward nation to catch up with advanced nations, the backward nation--while strengthening its work in scientific and technological research, key tasks and development--should at the same time make full use of the world's existing scientific and technological results in order to change from being weak to being strong. There is no exception from ancient time to the present. In their heyday, the Han and Tang dynasties boldly absorbed foreign things. Peter the Great of Russia humbly went abroad to learn shipbuilding from Holland, an act that is praised in history books. Japan's Meiji Restoration found national revival in the opening of sea transport and the import of Western technology. The early stage of industrial development in the United States relied on the advanced technology of Europe at that time. We should draw lessons from Japan's import of technology after World War II. Initially, Japan imported complete sets of equipment in order to rebuild her economy. In the last 20 years, she primarily imported "software"--blueprints, data and patents--spending an average of 1 billion U.S. dollars each year in importing 2,000 types of technology. As a result, Japan suddenly became the second largest economic nation in the capitalist world. The Soviet Union has also attained very handsome results in importing technology. In 1932, making use of the world economic crisis, that country imported 60 percent of the total export volume of mechanical equipment in the world. We can say that the large-scale import of advanced technological equipment played a considerable role in speeding up the Soviet Union's industrialization and in her victory in World War II. Here, Zhu Rongji stood up and said excitedly: "History has proved that

"borrowing" is very effective. If we borrow with precision and properly, we can bypass some intermediate stages in technological development, win time, raise our starting point and advance by leaps and bounds. Why not go ahead with such a fine thing?"

"Since the nation's founding, haven't we often 'borrowed'?" the reporters interrupted, adding, "and it was not easy either." Zhu Rongji said: "We have gained experience and learned lessons which we should remember. We can talk about three separate stages. During the 1950's, we were engaged in 156 projects, most of which involved complete sets of equipment and fully equipped factories. During that time, our country's industry was a blank page so we had no choice but to do that. Later, these projects did indeed become the basis of and play an indelible role in our country's industrialization. The so-called complete sets of equipment were referred to abroad as 'turn-key factories.' In the early 1970's, we again became engaged in 13 large-scale chemical fertilizer projects, which basically improved our country's chemical fertilizer production, doubling and redoubling output. Unfortunately, however, we were still unable to gain a foothold in producing parts at home and spent foreign exchange in importing parts from aboard. At the third stage, in 1978, we imported 22 projects, but we overextended ourselves and exceeded our country's financial and material strength. What we imported were still "turn-key factories." In order to strengthen key construction projects, we still need to import some large-scale, complete sets of equipment, such as the technology and equipment for nuclear power stations. However, if we still do not attach importance to importing technology and improving existing enterprises, in particular to transforming the backward technological appearance of the multitudinous medium-sized and small enterprises, then the four modernizations will prove impossible."

"Then how can we publicize the importance of the '3,000 import projects'?" we asked. Pausing for a moment, Zhu Rongji said: "Setting slogans is crucial to publicity work, and for this task the CPC Central Committee and the State Council have established 'import advanced technology and transform medium-sized and small enterprises' as our watchwords. Thus, we must strive to publicize the importance of both importing 'software' and transforming medium-sized and small enterprises. Every time we mention our myriad medium-sized and small enterprises, people feel that we are forced to run more medium-sized and small enterprises because China is poor and backward. This is not true. Such enterprises also constitute the majority of all enterprises in industrially advanced nations. We cannot underestimate these enterprises' important position in the national economy. For instance, Japan has 6.27 million enterprises, 6.23 million, or 99.5 percent, of which are medium-sized and small enterprises. Thus Japan attaches great importance to the technological transformation of her medium-sized and small enterprises, the technological level of which is generally equal to that of large enterprises. Our country has many medium-sized and small enterprises, which produce basic, component and compatible parts for the projects of large enterprises, as well as the daily necessities that are vital to the people's livelihood. But the technological facilities of medium-sized and small enterprises fall far short of advanced international levels. This backwardness poses a major

problem if we want to rely on such technological facilities to satisfy the needs of modern, large-scale production and the daily growing material and cultural living standards of the people, as well as to realize the goal of quadrupling gross industrial and agricultural output value by the end of this century. If we can send satellites into space, why can't we make people's daily consumer products more abundant and colorful?" Here, Comrade Zhu Rongji cited an example. A large department store in a foreign country had over 10,000 kinds of belts, while for many years we only had a total of several tens of kinds of canvas, plastic and leather belts. Now our situation has improved. But the phenomena of poor quality and little variety still basically persist. We need to exert much effort in transforming medium-sized and small enterprises. There are many advantages to importing advanced technology and transforming medium-sized and small enterprises. Little money is used and fast and high results are scored; we can renew and replace products without delay; very little risk is involved; we can launch a project with only several tens of thousands or several hundred thousands of yuan; and even if we suffer losses, these losses will be nothing major. Zhu smiled and said: "Of course, suffering losses, being cheated--I am talking in extreme terms. We must strive to do our work well and try our best to avoid losses." Zhu Rongji held that in the past, we attached too much importance to importing large-scale and complete sets of mechanical equipment. We only got the keys but could not become independent technologically. In contrast, importing software means importing patents, the tricks of the trade, skills and management technology. We can comprehend by analogy, digest what we import, create new things and basically "borrow." This should be our major direction in technological import.

For more than an hour, Zhu Rongji talked volubly. We listened with great interest to his many fine examples of "borrowing." A sealing parts factory in Tianjin only used 690,000 U.S. dollars to "borrow" a blueprint for sealing parts from a British company, thus improving product quality. The factory spent little money in exchange for extremely great results, and saved 2 million U.S. dollars in foreign exchange for the state.

We understand that technology import work already has a good start, but progress generally remains slow. No breakthroughs have been achieved, while many obstacles persist. For this reason, the leading comrades of the CPC Central Committee have instructed us on many occasions that "importing technology and transforming medium-sized and small enterprises are different from importing large-scale and complete sets of equipment. We must be bold, appropriately liberalize policy, decentralize approval authority and strive to simplify administrative procedure." "We must implement reforms to create a new situation." At this point, Zhu Rongji knitted his brows and said that, in import work, there are systemic problems, and some comrades still have many ideological misgivings. For instance, such comrades are worried that large-scale import will engender redundancy. Without a doubt, we must prevent redundant import. The key is that the entire country must adhere to the plans for technological transformation and sectoral technological imports. But we must also realize that it is unrealistic to avoid redundancy altogether, since there are so many medium-sized and small enterprises throughout the

country. We need not fear short-term, minor redundancy when we import, with marked economic results, those items that we cannot manufacture at present or well. Of course, in importing the "3,000 projects," we are primarily engaging in those projects that will raise quality, increase variety, lower energy and raw material consumption and raise overall social results. We do not seek merely expanded production and profitability. We can utilize more foreign exchange from the Bank of China and foreign capital through various channels in promoting those projects.

At the conclusion of this interview, Zhu Rongji told these reporters that the open-door policy is our national policy and that our unswerving principle is to import advanced technology and strengthen self-reliance. The CPC Central Committee, the State Council and the people throughout the country are extremely concerned about the progress of the "3,000 advanced technology import projects." The State Economic Commission has been instructed to cooperate with other departments and do this work well and is profoundly cognizant of its great responsibility. We must have a sense of urgency, adopt decisive measures as soon as possible, coordinate relationships among the various departments, launch foreign affairs work in unison and swiftly create a new situation for import.

9335
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PROBLEMS IN DRAFTING PROGRAM FOR INDUSTRIAL PROGRESS DETAILED

Beijing JINGJI RIBAO in Chinese 9 Jul 83 p 4

[Article by Zhu Tao [2612 3614] and Wu Weili [0702 1218 4539]: "Some Problems in Drafting a Program for Technical Progress in Industry"]

[Text] Technical progress in industry requires that we first develop a program, which requires much difficult, painstaking work; below we present some opinions on several of the problems involved.

We Need the Guiding Idea of the "Three Generations"

In order to achieve the great goal of quadrupling gross industrial and agricultural output value by the end of the century based on improved economic results, we must make a major effort in technical progress, popularize among the majority of our mining and manufacturing enterprises the advanced production technologies which were in general use in the economically developed countries during the 1970's and early 1980's and which are suited to our needs, and create a Chinese-style technological system. This is our basic objective and yardstick in drafting a program for technical progress in industry.

In order to achieve technical progress, in accordance with the Central Committee's strategic plan of laying the foundations in the first 10 years and achieving vigorous development in the second 10 years, we must draft a development program divided into long-term, mid-term and short-term phases, i.e. measures for the period to 1985, hypotheses for 1990, and prospects for the year 2000. These programs must be detailed for the nearer term and more general for the longer term, and must be developed on a sliding basis, with continual revision and improvement. The program for any of the periods, for example that for measures through 1985, must also be detailed for the immediate period and general for the longer period, but the degree of detail or generality will be different from that used for the later stages. In particular, for this year and next year the work required for technical progress must be broken down into individual topics supported by specific actions; it cannot be a mere blueprint.

In general, technical progress will ultimately be expressed in products. Drafting of a plan must organically combine the near term and the long term,

the general and the specific; figuratively speaking, it must involve "three generations," i.e. an improvement generation, a development generation and a long-range development generation. In addition to a generation of products which are currently in production, we must consider which products will be improved, which will be developed, and which should be the subject of long-range development. This is one guiding idea for developing the program. In this way, as products mature and decline, and as time passes and market needs change, the original "production generation" will be abandoned, the "improvement generation" will change into the production generation, the "development generation" will turn into the improvement generation, the "long-range development generation" will become the development generation, and there will be new subjects of long-range development. Of course, we are talking about the macroscopic scale and the general situation; we do not mean that one generation of products will all be replaced at the same time or that all products must be updated. In addition, generations are not equally spaced or rigidly demarcated: they must be defined in terms of needs and possibilities. Some people use the apt metaphors of "looking three moves ahead in chess" or "eating one thing, looking at another, and thinking of a third" to interpret the "three generations."

Planning in terms of the three generations can allow industrial products to have a specific emphasis during a particular time period while also developing in terms of a long-term perspective involving generation-by-generation replacement, avoiding both reproduction or outmoded products and unplanned, unfocused, uncoordinated efforts. The Ministry of the Machine Building Industry's system has 31,000 product varieties in production. Its preliminary development program requires that 13,600 varieties or 14 percent of the total be modernized, while 13,000 varieties or 42 percent are to be newly developed or updated. About 10,000 varieties are to be under long-range development before 1990. This program maps out a clear, sequential preliminary plan for the development of the machine building industry's products. If this approach can be taken for a branch of industry, it should also be possible for an area, an enterprise and even for individual product categories. The energy, extraction and materials industries do have the problems of product updating and replacement, of course, but the more important requirements are those of developing new processes and technologies, and thus their programs naturally will have a somewhat different focus.

Interconnected With Readjustment and Reorganization

There are many irrational aspects of China's manufacturing structure, product mix and enterprise organization which must be gradually corrected in the course of readjustment. The drafting of programs for technical progress in industry must take thorough account of the great effect of readjustment of the national economy.

Reorganization requires that we rationalize organizational structure and management, and technical progress requires modernization of production technology; these two factors are closely interconnected and mutually supporting, and they must be intertwined in technical modernization programs

rather than approached like "a vehicle trying to drive on two different tracks."

We must conscientiously analyze the characteristics and advantages of a given industry or area and determine, with reference to the overall tasks of the national economy, what products and technologies should be developed and which should be abandoned; we cannot simply strive to "catch up" or "fill in gaps" without any clear objective. For example, the computer and large-scale integrated circuit [LSI] industries have long lacked a unified program, and each department has wanted to be a self-contained system itself, with the result that there was no standardization of models, the industry was geographically dispersed, more than 200 different product models were developed, of which only two went into lot production, and primitive, repetitive construction spread steadily. When the state council's computer and LSI circuitry leadership group was formed, it took account of the characteristics of this technology-intensive branch of industry, with its high precision, wide range of applications, large resource requirements, carried out extensive surveys, held repeated expert discussions, identified breakthrough points, selected the best products for support, focused on correcting the geographical dispersion of the industry, and drafted a unified, overall program which was supported by all parties involved. Again, the advantages of Shanxi Province are its rich coal resources, with proven commercial deposits accounting for a third of the national total, and with a multiplicity of varieties and good quality. Therefore, the state has decided to establish a coal and heavy industry base centered in Shanxi. Thus Shanxi Province had to consider thoroughly how to make use of this advantage and to work around its disadvantage of insufficient water, to make the necessary adjustments in its manufacturing structure and product mix, and to draft a comprehensive regional plan suited to the local conditions.

Modernization is inseparable from specialization, and only by changing over from general capabilities to specific capabilities and concentrating these specific capabilities into a general capability can advanced technology be more effectively disseminated and applied. Therefore, the important principle of reorganization of industry through specialization and cooperation must be conscientiously applied in developing technical-progress programs. Otherwise the current widespread problem of large and small self-contained production will go unsolved and may even worsen. Many plants in castings, forging, heat treatment and electroplating fields are small but include all production stages from the ground up; using outmoded processes with extremely low efficiency. If modernization is undertaken without adjusting this problem, waste will become more serious as technology becomes more advanced. Beijing has carried out a preliminary adjustment and modernization of these four major process industries. It started by decreasing the number of plants and workshops by 351, which saved 13.51 million kWh of electricity, 36,000 tons of coal, 252 tons of water over the course of 2 years and laid the groundwork for further raising of technical standards.

Focus on Improving Economic Results

All of our economic work must shift its focus to improving economic results, with technical progress receiving top priority. We have already learned

some lessons in this extremely important matter. Some enterprises went after progress indiscriminately, achieving the appearance but no real results; some projects tried to have their cake and eat it too, taking no account of either production costs or consequences. Some projects were long unable to yield the proper results after their completion. This problem has still not been entirely overcome, and the draft programs which some industries have worked out are specific about investments but take no account of the results that will be realized. This point merits close attention.

In considering economic results, the results for society as a whole and the long-term results must be given top priority. Some programs may be losing propositions when considered in isolation but will produce overall benefits; some may have limitations at present but have great long-term potential, so that they must be undertaken. For example, although the energy situation is currently tight, it is manageable; however, for total agricultural and industrial output to quadruple by the year 2000 when energy output can only double constitutes a major long-term problem. All technical-progress programs must give top priority to conserving energy and materials in order to open the way for solution of this problem. Product quality is another problem. Because of current irrational prices and other factors, improving quality will not necessarily bring great benefit to the departments or enterprises which do so, and some may even lose money. But improving product quality will have good economic results for society as a whole, so that all programs must unwaveringly accord top priority to product quality.

Technical progress must be examined in economic terms, and the money must be spent only after the calculations are made, not the other way around. A great deal of research must be conducted on the current domestic and foreign situation and on development trends and market tendencies, repeated expert evaluations involving technical personnel must be organized, alternative programs must be developed and compared, and an energetic effort must be made to select the optimal ones in order to realize the maximum results from the smallest investment. When the Construction Bank made a survey of three fossil-fired power stations using imported equipment which went into operation in 1978, it found shocking differences in their economic results; in terms of best past profits, the investment recovery periods for the three stations were 3 years 1 month, 22 years 1 month, and 24 years 1 month. In the case of the best plant, there had been a good understanding of the relevant circumstances abroad, the imported technologies were advanced, and equipment quality was good, the surveying and design had been thorough, site selection had been rational, and domestically produced supporting facilities and construction work were able to keep pace. In the case of the two plants whose results were poor, the equipment which they imported was of poor quality; in one case the energy resource situation had not been clarified in the haste to get started, so that there was a lack of fuel and production costs were high; and in the other case, there had been a failure to coordinate with coal mine construction, which hindered normal operation. If importation projects have these problems, projects involving domestic development require even more painstaking surveys, repeated evaluations, and careful construction in order to achieve good economic results.

A realistic approach and an effort commensurate with abilities are particularly important to economic results. Funds requirements must be in line with the country's capabilities. Technologies chosen must be neither conservative nor infatuated with things foreign; but the main aspects and key technologies must be grasped and the money spent where it will do the most good. The technical standards of various types of enterprises in the iron and steel industry are extremely uneven, and it will not be possible to bring them all to the same level in the future, so that we will have not only the level achieved by Baogang, the level that is currently being modernized at Shougang and Angang, and many enterprises which require further adjustment and modernization. This situation of "several generations in the same hall" is practicable and economically rational.

Draft Fully Coordinated Programs

Research, production and use in modern industry constitute an organic whole, and all departments and branches are interconnected, interrelated and mutually constraining. The expansion or shrinkage of a given product or enterprise cannot take place in isolation. For a long time there has been a lack of close connection between science and production and between production and use in China, resulting in the emergence of many experimental models of products, of which few have actually gone into production, as well as poor-quality products which lack markets. In order to effectively convert science and technology into productive forces, we must overcome this lack of connection with the real world and must draft fully coordinated technical progress programs.

Full coordination means that all component aspects are provided for; there must be many types of coordination, both vertical and horizontal. First, following effective market forecasting, we must work back from the product and plan all aspects in coordinated fashion from beginning to end, including key technical efforts, new product development, importation and assimilation of new foreign technology, popularization and utilization of domestic scientific results, technical modernization and capital construction, and the lot production of new products. This approach will avoid overemphasis on some aspects with neglect of others, and thus will convert science and technology into productive forces. When China focused on the "nine main types of equipment" in the 1960's, it coordinated experimentation, design, manufacture, testing, installation, use and maintenance, thus demonstrating the superiority of the fully coordinated approach. We must conscientiously summarize experience of this type and use it for other projects in capital construction and technical modernization.

Another aspect is coordination with reference to the main products, in which full coordination with the industries affecting them is organized. This is particularly important for regional programs. For example, Tianjin has 18 industries, 32 plants and 13 research institutes involved with chemical fibers and products made from them. Initially, research was out of touch with production and production with needs, management was dispersed, and technical standards were low. In order to develop new fibers, new textiles

and new products in coordination, to promote specialized production and to speed up the development of chemical fertilizers and their products, the relevant departments in Tianjin organized the chemical fiber industry's research, production and supporting units to jointly draft a fully coordinated development program, which has already been yielding excellent results. Examples of this type show that drafting fully coordinated programs requires that the parties involved give them joint consideration, take account of the overall situation, and coordinate closely, breaking the fetters of the department or area ownership system and making a contribution to the creation of a new situation.

Focus on the Key Factor, i.e. Industrial-Branch Programs

Industrial technical progress programs are hierarchical. Nationally, they should be integrated with economic and social development, forming a threefold overall program. In addition, industrial branches and geographical areas (including central cities) and enterprises (particularly key enterprises) must have their own technical-progress programs. Naturally these programs too must be integrated with and agree with the relevant economic and social development programs.

Technical-progress programs at the national, industrial-branch, geographical area and enterprise level must be intercoordinated, and their drafting must proceed in tandem and in a mutually supportive fashion. The national program must be based on the programs at the lower levels, which must be carried out under the guidance of the national program. Because of the interpenetration and close interrelationship of these different types of programs (including relationships between industrial branches and between geographical areas and between enterprises), repeated vertical discussions and horizontal balancing are necessary in order to arrive at a good overall program; it cannot be achieved in a single step.

Among these four types of programs, the industrial branch programs are the key. Because they serve the important function of vertical linking and horizontal balancing, they are the basis for the state's consideration of the overall program and are also the inputs for drafting of the geographical areas' and enterprises' programs. Once the overall objectives of development of the national economy are specified, the industrial branches should, as far as possible, take the lead in drafting technical-progress programs. For example, the machine building, electronics and textile industries handed down preliminary technical-progress programs which were well received by the geographic areas and enterprises involved. The energy, communications, materials, parts, and basic components industries should also produce programs as quickly as possible.

The drafting of an industrial-branch program should begin with designation of the branch's technical policy and technical equipment policy. Without a correct and relatively stable technical policy, technical progress will lose any clear orientation and may bog down, resulting in great losses and waste. For example, should the iron and steel industry develop oxygen

converters and new, large-scale continuous casting equipment? How should we utilize the advantages of our nonferrous resources and develop low-alloy and alloy steels? How should the chemical fertilizer decrease its energy consumption and adjust the relative proportions of nitrogen, phosphorus and potassium? Should it develop concentrated high-complexity fertilizers and reprocessed mixed fertilizers? All of these matters must be determined first and the requisite technical equipment policy for them must be drafted in order to provide the preconditions for drafting the industrial branch technical progress program.

In drafting these programs, balancing between different industrial branches and between industrial branches and geographical areas must be taken into account. For example, the development of the machine building and electronics industries requires the support of the metallurgical, chemical engineering, building materials, petroleum and other materials industries; the development of the metallurgical industry must take account of the needs of machine-building, electronics, light industry, textiles and chemical engineering and in addition energy and transport capabilities; its overall transport volume, overall energy consumption and overall building materials volume not only must be included in the state plan, but must also be balanced with the various area programs if they are to be effectively implemented.

8480
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VIEWS OF MUNICIPAL REPRESENTATIVES ON TECHNOLOGICAL REFORM

Beijing RENMIN RIBAO in Chinese 22 Jun 83 p 5

[Article by Gao Xinqing [7559 2450 1987]: "Suggestions on Technological Reform and Economic Growth Offered by Representatives of the People's Council of Tianjin"]

[Text] Valuable opinions and suggestions were offered by representatives of the People's Council of Tianjin to the question "How to accomplish the Sixth Five-Year Plan and be ready for the new era of economic growth?"

Representative Yang Xuemin (female, vice president of the Tianjin No 2 Relay Factory, engineer) made the following comment based on experience at her factory: "We can no longer follow the slow path of '1+1=2'. We must be liberated from the old policy of the past 3 decades, which emphasized production, basic construction, and reform of light technologies. We must devote our efforts to making large technological advances with the objective of raising our technological standards and increasing productivity, so that our economic development will follow the path of '2x3=6'."

Representative Li Zhizhen (vice chairman of the Tianjin Association of Science and Technology, engineer) expressed total agreement with a statement made by Premier Zhao in his government work report: "Technological reforms in industries, like key construction projects, are prerequisites for accomplishing the Sixth Five-Year Plan and achieving economic growth." He said that doubling Tianjin's economy will to a large extent depend on technological reforms and technological progress. In the past, Tianjin was considered experienced and successful in technological reforms, but there were also some problems. Technological reform of industries must begin by raising the technological standards. It is not enough just to expand the floor space of factories, acquire new equipment, new product techniques, and to improve the quality and varieties of new products.

Representative Li Qizu (vice president of Tianjin No 2 Bicycle Factory, deputy chief engineer) believed that to achieve technological reforms in industries, it is important to focus on the advanced technologies in this country and abroad, and to pay close attention to market feedback. He suggested concentrating our efforts on developing new products and improving product quality and varieties to meet the objective of increasing economic benefits.

He also emphasized energy conservation, revolving guarantees, and establishing regulations designed for the development of new products, new technologies, technological reform, technological cooperation, and the absorption and digestion of new technologies.

Rong Xuezhen (female, director and chief engineer of Tianjin Light Industry Paper Manufacturing Research Institute) was critical of the fact that research and development had been neglected for so long in China and of the inability to implement the results of scientific research quickly and extensively in production. She suggested that a technology development center be organized to establish policies and plans for technological reforms, and to organize the efforts of implementation. To achieve greater economic benefits, she also suggested the development of "knowledge-intensive" products and devoting our efforts to basic research. Pointing at the polychlorostyrene walls, she said: "Today's paper is no longer made of vegetable fiber alone. Through the development of modern technology, it is now possible to combine vegetable fibers with other materials such as aromatic polyamide, fiberglass, aluminum foil, plastics, etc., to produce colorful new products and materials for the food packaging, medicine, communications, building materials, and the defense industries. To do this requires new knowledge and new technologies. Therefore, it is essential to pursue research and development by organizing a technology development center."

Comrades Li Zhizhen and Rong Xuezhen also made the following suggestions:

1) Establishing a Carefully Thought-Out, Long-Term Plan for Technological Reform and Technological Advancement

The plans of technological reform for the nation and for the city should be established on the basis of those for businesses and key industries. The most important issue in planning business technological reform and development is to decide on the direction of development, the level to be achieved, and the policies and equipment to be used.

2) Emphasizing the Absorption and Digestion of New Technologies

Efforts should be made to absorb foreign and domestic advanced technologies and to organize a task force to digest them. Emphasis should be placed on single-item and software technologies so that immediate payoff in industrial technology improvement can be achieved with a minimum amount of investment. According to statistical data, Japan spent 20 billion U.S. dollars between 1950 and 1978 importing technologies and equipment from abroad. Of this amount 7.66 billion dollars was spent in bringing in almost 30,000 pieces of technologies which included most advanced technologies developed over the last half century by various countries with a total investment of more than 200 billion dollars. This resulted in a saving of two-thirds of development time and nine-tenths of development funds. Eighty percent of the imported technologies were in the form of purchased patents. From 1950 to 1979, China signed import contracts worth 14.5 billion dollars; however, most of the imported items were technologies but complete units of integrated facilities. As a consequence, we spent a comparable amount of money

as Japan did, but the derived economic benefits were considerably less. It is generally agreed that we took the wrong path and we paid dearly for learning the lesson; we must become much wiser in the future.

3) Establishing a Series of Policies To Promote Technological Reform and Technological Advancement

Over the years our views and policies were focused on getting quick returns. These policies have hindered scientific and technological progress and must be changed in the future.

3012
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VIGOROUS PROMOTION OF TECHNICAL PROGRESS STRESSED

Jinan DAZHONG RIBAO in Chinese 29 May 83 p 1

[Article by staff commentator]

[Text] To vigorously develop the economy it is necessary to depend on scientific and technical progress, and this is a very important problem. At present, we are faced with this situation: If technical progress is not stressed, then it will be impossible to continue to improve economic results, to accelerate the rate of development, and to realize the strategic goals proposed by the 12th Party Congress. Thus, leading comrades on all levels of industrial and communications departments must improve their knowledge, genuinely change their ideology of stressing production and capital construction but slighting technical reform, fully see the vast potential of the enterprises, and devote their major energies to striving for technical progress.

In order to vigorously promote technical progress, it is necessary to make great efforts to do a good job of carrying out trial-production of new products, expanding new technology, tackling the key problems of science and technology, and planning to create advantages. Development of new products is the "key" to technical progress, and based on unified planning and according to social needs, we must fully develop each technical advantage, formulate plans for development of our own new products, truly achieve a generation of production, reserve, trial-production and planning, and improve the ability of industrial production to meet market emergencies. Moreover it is necessary to vigorously strengthen the technological foundation work, such as in standardization, measuring, inspection and prediction, information, consultation and training. If the technological foundation work cannot be strengthened, then there will be no dependable guarantee of technical progress.

Doing a good job of technical reform in existing enterprises is the major aspect of promoting technical progress. To construct a group of large-scale backbone enterprises which have decisive economic lifelines and overall influence is absolutely essential, this is the existing hope for vigorous economic development, and we must definitely mobilize our forces in all areas to help to stress this construction. But it is also necessary to pay great attention to technical reform in existing enterprises; otherwise construction of the

"four modernizations" will be unable to be successfully carried out, and it will be difficult to realize our strategic goals. In technical reform, it is necessary to stress doing a good job of two things: The first is strictly preventing the use of technical reform funds for capital construction; the second is truly using technical reform funds to improve technology, to improve product quality, to increase product variety, and to renew and exchange. It is necessary to pay close attention to doing a good job of planning technical reform, carrying out plans, and clarifying technical reform goals, technical development directions, technical equipment standards and technical policies which must be adopted. Technical reform planning must be opportunely coordinated with enterprise revision, reorganization, and the promotion and use of new technology to continuously expand the achievements of technical reform.

Accelerating the introduction of technical equipment and the rate of reform of small and medium enterprises is a shortcut to promoting technical progress. A host of facts has proved that being good at assimilating advanced technology which other nations and countries have developed is sufficient to accelerate one's own rate of development. Therefore, we should pay great attention to the work of introducing technology; we must relax policy restrictions and simplify procedures; and faced with improving quality, increasing variety, building a foundation and raising standards, we must develop product categories, fill technical gaps, conscientiously stress the introduction of technology and the digestion, assimilation and promotion of equipment, and progressively blaze new trails.

To do a good job of technical reform, in the final analysis it is necessary to depend on scientific knowledge and on scientists and technicians. In order to have faith in scientific knowledge, and to respect and support scientists and technicians, it is necessary to trust and depend on them politically, to care for and help them in their lives, and to supply and create the essential conditions for them in their work. It is necessary to pay attention to choosing intellectuals for leading groups, and to improve the assessment system and reward policy for scientists and technicians. In areas such as tackling key scientific and technical problems and developing new products, it is necessary to make the individual responsible for carrying out the task, and to carry out a strict technical contract responsibility system. Only in this way will it be possible to give full play to the wisdom and creativeness of scientists and technicians, and to make the proper contributions to doing a good job of technical reform and of promoting technical progress.

12267
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DENG XIAOPING'S VIEWS ON TALENT, FOUR MODERNIZATIONS ANALYZED

Lanzhou GANSU RIBAO in Chinese 28 Sep 83 p 4

[Article by Qiu Shaowei [8002 1421 0251]: "Talent is the Key Issue in the Four Modernizations--Realizations from Studying 'The Selected Works of Deng Xiaoping'"]

[Text] Comrade Deng Xiaoping has given a systematic, all-encompassing and scientific exposition concerning the relationship between knowledge, education, talent and the four modernizations in the following documents: "Respect Knowledge, Respect Intellectuals," "Some Suggestions Concerning Science and Education," "On Bringing Order out of Chaos on the Battlefront of Education," and "Address to the National Meeting on Education." Deng says, "the crucial point in realizing modernization is technological development. To develop science and technology [S&T] we must first pay attention to education. Empty words cannot effect modernization. We must have knowledge and talent, without which, how can S&T ever advance?" (Selected Works of Deng Xiaoping, p 37.) Such a penetrating analysis and a scientific thesis reflect the fact that, in order to meet the needs of socialist modernization, our party attaches great importance to education and trained personnel and has made a series of strategic decisions guiding the basic mission of and direction for improving education, training talent and successfully implementing the four modernizations.

To develop our economy and realize the four modernizations, resources, capital and trained personnel are all indispensable and form an indivisible whole. Trained personnel is particularly important, as it is the most active factor in the production force.

Currently, the quality and quantity of scientists and technicians a country has served as an important indicator of the country's strength. As Comrade Deng Xiaoping has pointed out, "Compared with those advanced countries in the world, our S&T and education are fully 20 years behind. The United States has 1,200,000 scientists and technicians; the USSR has 900,000; but we have only 200,000, including those who are aged, sick and frail. Those who can be of real use are not many" (p 27). Regardless of which social systems they adopt, all advanced countries share one common characteristic, which is their stressing of the discovery, training and use of talent. American education, especially high education, is well developed. There are more

than 3,000 higher educational institutions, whose students total over 10 million. In Stalin's era, the USSR was able to absorb a large number of foreign scientists and engineers during the 1929-1933 worldwide capitalist economic crisis. These highly trained people helped the Russians develop their economy and achieved great results. During World War II, because of the Fascist persecution of scientists in Germany and Italy, many scientists, engineers, professors, physicians and other intellectuals fled to the United States. At that time,the U.S. government adopted the policy of attracting talent and was able to successfully develop atomic bombs, radars, and rockets essentially by relying on the expertise of these foreign scientists. The 10 professors who submitted the atomic research plan included Einstein and Fermi but only one American. Six out of the eight Americans who won the Nobel prize in physics were immigrants from Europe. Obviously, these immigrant scientists have made enormous contributions to U.S. economic, scientific and technological development.

According to U.N. statistics, between 1960 and 1972 almost 300,000 scientists, engineers and physicians were drawn from the Third World by advanced nations like the United States, Great Britain, France, West Germany and Canada. Between 1946 and 1974, the United States assimilated 240,000 high-level scientists, engineers and physicians from foreign countries.

Thus it is obvious that, if a nation seeks rapid development, qualified personnel are crucial. Without such personnel, our four modernizations will become an empty phrase.

We must tap our potential and develop new talent resources. Comrade Deng Xiaoping pointed out poignantly, "To catch up with advanced countries, I think we must start from improving science and education" (p 45). The fundamental mission of scientific research and education is to get results and to produce able persons who are both socialist-minded and vocationally proficient.

The 12th National Congress of the Chinese Communist Party made education a strategic key point in the modernization of our country. To carry out this crucial strategic decision, we must adopt powerful measures to reverse the imbalance between education and national economic and social development. And this makes it urgently necessary for us to tap our potential, expand the sources of talent and thus provide more and better professionals in various fields. To this end, ever since the Third Plenum, the CPC Central Committee has adopted the following crucial series of measures.

1. Require that job assignments be geared to candidates' special training in order to eliminate the problem of employing people outside of their fields. Comrade Deng Xiaoping has proposed: "We must fully utilize intellectuals' special training. It is not good to use them in ways other than what they are trained for." "For those who are employed outside their field of special training, we should call back those who are up to standard and who promise good results should they be given further training" (p 48). Ever since the smashing of the "gang of four," we have solved this problem by employing

large numbers of recent college graduates in vocations for which they have had special training. This practice has enabled us to make better use of intellectuals who have special skills and to reduce some of the shortages in talent urgently needed in the four modernizations.

2. Include intellectual development as one of China's key areas for investment. "Education is the foundation for cultivating S&T talent" (p 92). To enhance educational development, especially in higher education, we must strive to provide the necessary operating expenses and capital construction investment and run schools on many levels, of many standards and of many forms. Our aim is to produce quality personnel in large quantities as soon as possible. Thus will China's education show tremendous advance. In the next 5 years new college-student enrollment will increase annually. By 1987, new enrollment in full-, daytime colleges will reach 550,000, a 75 percent increase over 1982. Enrollment in telecommunication, night and correspondence universities, universities established by units for workers and staff, peasant universities run by counties, managerial cadres' colleges, education colleges or teacher retraining colleges, etc., will grow from 290,000 in 1982 to 1,100,000 in 1987, an increase of 2.8-fold. We will do everything we can to enlarge the scale of new student enrollment and prepare qualified personnel for vigorous economic development in the 1990's.

3. Send students abroad to study and invite foreign scholars to lecture in China. To catch up with the advanced countries, we must not only fully utilize our current personnel, but also accept scholars of Chinese ancestry to come back and work or dispatch students to study abroad. "In addition, we will invite famous foreign scholars to lecture in China. Many of the scholars who are friendly to our country are famous. It is a good practice to invite foreign scholars to lecture here" (p 54). Comrade Deng Xiaoping asked concerned departments to create conditions and make preparations so that these people can contribute to our socialist modernization.

4. Be good at discovering, selecting and training outstanding personnel. Comrade Deng Xiaoping has stressed, "We must go out of our way to discover, select and cultivate talent" (p 93). We need all kinds of talent to carry out the four modernizations. "Every profession produces its own leading authority." For instance, "there is also talent among elementary and secondary school teachers; good teachers are good talent" (pp 47-48). "Logistics is a field of learning, and talent can also come out of this field" (p 53). It is indeed an achievement and a contribution to society for scientists and teachers to discover talents and educate them. Some of our scientific inventions have been highly valued and lauded by foreigners but go unnoticed in our own country. This shows the defects of our system. We must treasure our gifted personnel. They are hard to get!

In order to select and to educate a group of outstanding scientists, Comrade Deng Xiaoping advocates, "We intend to select several thousand of the best persons in the S&T system. We will then create the proper conditions so that they can give their research undivided attention" (pp 37-38). We will help them solve problems they encounter in everyday life, show concern for

them both politically and in ideology and trust and support their work. We should not be overly critical or demand that they be perfect human beings. As long as they do good work in research and produce results, they will benefit politics, contribute to the human race and elevate the scientific level of the Chinese race.

We should respect knowledge and talent. Lin Biao and the "gang of four," out of their antirevolutionary political needs, persecuted intellectuals on a large scale. In their struggle for power and to usurp the party, they reversed black and white, confused right and wrong and proclaimed the absurd theory that "the more knowledge one has the more reactionary one becomes." In total lunacy, they labeled many scientists, professors and engineers who have made great contributions in the past "reactionary academic authorities," slandered superior young researchers as "seedlings of revisionism" and falsely accused the 17-year educational front of being a "black-line dictatorship." The broad masses of intellectuals were smeared as "the stinking ninth category" and were made targets of dictatorship.

To remedy these criminal acts, Comrade Deng Xiaoping, as early as 1975, pointed out the need to "give free rein to the initiative of S&T personnel," and to "relieve scientific and engineering personnel's depression" (p 26). Since the smashing of the "gang of four," Comrade Deng has worked to restore order to the chaotic conditions in education in terms both of theoretical direction and of policy. He affirmed that the "guiding principle of the 17-year educational front was the red line. Almost all the basic strength of all fronts were cultivated by ourselves after the founding of the People's Republic, especially during the first two decades" (p 46). In fact, after Liberation, the party nurtured and educated many fine intellectuals who are both socialist-minded and vocationally proficient. People such as Peng Jiamu, Luan Fo, Jiang Zhuying and Luo Jianfu are loyal to the country, the people and the party and dare to scale the heights of science. Fact has overthrown the "two appraisals," which had intimidated intellectuals, and aroused the socialist initiative and enthusiasm of intellectuals.

Comrade Deng Xiaoping stressed that "we must create an atmosphere in our party which is conducive to respect for knowledge and talent and oppose erroneous thought which does not respect intellectuals" (p 38). Representing the CPC Central Committee, Deng Xiaoping repeated that the great majority of intellectuals are part of the working class. Such brilliant expositions form the guiding principles for our party's policies toward intellectuals.

In conclusion, since the CPC Central Committee values education, pays great attention to scientific undertakings and attaches great importance to the training and selection of talent, "we can predict that a new age will soon come in which people of talent will emerge in large numbers like glittering stars outshining one another" (p 92).

12453
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MORE FLEXIBLE ALLOCATION OF SCIENCE, TECHNOLOGY PERSONNEL ENCOURAGED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 8, 1983 p 31

[Article by Wang Changgen [3076 7022 2704]: "Openings for Allocation of S&T Personnel Should Be Wide Not Narrow"]

[Text] The human resource management system in China has often been criticized as being too rigid and having too much power. Our experience shows that such criticism is justified. In particular, we feel that the policy of assigning and allocating scientific personnel is too restrictive. For example, once a college graduate is assigned to a unit, he becomes the "possession" of the unit or the department. In the first place, a problem exists in the higher institutions in designing curriculum and producing college graduates according to demand. Also, due to the lack of coordination between the employer and the educator, some college students are assigned to positions poorly matched to their training; but because of the inflexibility of the personnel system, they must obey and remain in their assigned positions. As another example, the agencies directly concerned with the management and utilization of scientific and technical personnel include the science committee, the finance committee, the personnel organizing agency, and the ground-level employment units; but at present the only agency authorized to assign technical personnel is the personnel organizing agency. Although this facilitates the overall management of the labor force, it has some obvious disadvantages; e.g., it is difficult for financial and technical agencies to carry out planning of scientific and technological programs, planning of "critical projects," or to promote economic development.

Since the personnel departments cannot fully understand and appreciate the nature, the rules, and actual conditions of technology and the economy, it is difficult for them to make reasonable assignments or adjustments of scientific and technical personnel based on the needs of technical and economic programs. As a result, conflicts may arise between high level units in competing for technical personnel, and the efficiency of utilizing such personnel will be adversely affected.

For this reason, we believe that in order to correct the situation of inflexibility and concentration of power of the personnel management system,

the window of assigning and transferring technical personnel should be widened. Specifically, when a technical person is assigned to a ground-level unit, all agencies and units directly concerned with the management of scientific and technical personnel (primarily the science committee, the finance committee, the personnel organizing agency, and the employment units), should have the authority to participate in the assignment. It should be pointed out however that such assignments are limited to units within a city, a region, or a local system; the assignment of technical personnel across provinces and municipalities, regions, and systems (systems belonging to the central government) should still be the responsibility of the personnel departments in order to maintain an overall balanced distribution of population and proper circulation of labor force.

This approach has many advantages: 1) Better coordination between scientific and technological programs, and between production and technical personnel. Since the administrators in charge of technical and production departments are authorized to assign personnel, they will be able to allocate the required technical talents according to actual needs, thus achieving better match and higher efficiency. 2) Reduction in the bureaucratic procedures of reporting, negotiation and investigation for every assignment, thereby increasing operating efficiency. 3) Discovery and elimination of situations where technical personnel are placed in positions which do not match their background. 4) Promoting reforms in other aspects of human resource management system, e.g., recruiting, transfer, temporary assignment, etc.

Some comrades have indicated concerns that this approach may produce chaos in personnel management. Such worries are unnecessary. It is well known that economic growth depends on advances in science and technology; therefore, the talents of existing scientific and technical personnel must be fully utilized. On the national level, China is far behind other advanced nations in terms of the quantity and quality of technical personnel; on the local level, the distribution of technical personnel is so poor that there are severe shortages at some units and oversupply at others. Therefore, officials in the central government have repeatedly emphasized that in order to realize the benefits of the socialistic system, a coordinated effort must be made to organize the scientific and technical personnel to solve the critical problems facing the country. Such an effort is of strategic importance; also, it will set a precedence not only for the nation, but also for the provinces and cities, regions, and the individual departments. However, the assignment of technical personnel from various sources in a coordinated manner cannot be accomplished by any one department alone; it requires the combined strengths and resources of all the departments. This has been designated as part of China's current strategic mission. The utilization and management of technical personnel have unique features which are different from the appointment and utilization of Party and government officials. They should be allowed to contribute their special skills to serve directly for scientific research and production. It is thus logical to give the authority of managing and allocation of technical personnel to departments which are familiar with the characteristics

of technical labor. At present, the basic conditions for expanding the opportunities for technical personnel already exist. Specifically, the scope (local region, local unit, local department), the object (technical personnel), and organizational assurance (under the unified leadership of the Party organization) have been clearly defined.

In summary, proper assignment and allocation of scientific personnel is one of the essential measures for achieving the goal of the four modernizations in China; dedicated efforts would be required to correct certain deficiencies in the management system of China's technical personnel, to motivate the socialistic spirit of the technical personnel so as to benefit both the State and the people of China. Consequently, specific policies should be established and appropriate measures should be taken as soon as possible.

3012
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STRONGER, MORE FOCUSED TRAINING FOR GRADUATE STUDENTS ENCOURAGED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 8, 1983 p 32

[Article by Yao Dazhong [8026 1129 0022]: "How To Put New University Graduates on the Right Track of Science Research Work"]

[Text] With increased activities of scientific research, research organizations must continually absorb a certain number of new college graduates whose training provides them the basic theoretical knowledge in their special fields and the basic qualifications for performing scientific research. However, there still exists a big gap between their ability and the requirements of regular research work. When faced with a new research assignment, they are often lost and do not know how to begin. How should the managers and leaders in research institutes properly guide them so they can develop quickly and begin making contributions to scientific research? Based on the rules of scientific research, we believe in the policy of "training before utilization." In other words, before they are given a research assignment, the new graduates should be sent to the information center of a local unit (or institute) for a period of concentrated learning, and be assigned to work under a designated adviser. The research managers and leaders then suggest a plan for further development based on each individual's performance; only when the new graduates reach a certain degree of maturity are they given regular research assignments.

Such a learning period is necessary because the knowledge required for scientific research cannot be totally learned in the universities; on the other hand, not all the knowledge learned in the universities can be applied to scientific research. Indeed, the specialized knowledge required for scientific research can only be learned outside the university. The university is a place where one learns about knowledge accumulated by others, i.e., he merely receives training in a specialized field; scientific research on the other hand, is to explore the unknown and discover new knowledge; there is a clear distinction between the two. The work performed at scientific research organizations is of a creative nature; the breadth and depth of the knowledge required are far beyond the scope of knowledge learned in classrooms, laboratories, and workshops. In order to expedite the process of phasing new college graduates into the realm of scientific research, a new structure of knowledge transfer must be established. An effective and

necessary step to establish such a structure is to send the new graduates to the information center for a period of concentrated learning. Assigning them directly to the research institutes will present difficulties either in selecting a proper research topic due to lack of experience and lack of theoretical preparation, or in carrying out the research work due to insufficient knowledge and mismatched knowledge structure.

Progressing from the learning stage and student life to the stage of performing creative work requires a period of adaptation or a transition stage. This transition period is best spent in the information center. Under the guidance of mid and high-level research personnel, new graduates will be able to absorb new knowledge, get acquainted with the environment, explore the rules of scientific research, and formulate their own concepts about scientific research. Experience has shown that this is the most effective way to enhance the ability to do research and an important investment to achieve outstanding results. Generally, the technical development of scientific personnel is limited by the academic foundation established during their youth; working at the information center allows them to concentrate on learning the knowledge needed for research, to understand current technical trends, and to have access to the state-of-the-art achievements in modern science. This is highly important for broadening their views, and for developing their ability to think and to identify problem areas. Therefore, establishing such a program for new college graduates is advantageous both from a short-term point of view and from a long-term point of view.

It should be pointed out that the student must be able to extract the key information from a vast amount of materials; he must learn to be the master of information, not its slave; he should realize that more information does not always lead to better results.

The objectives of such a program are very clear. However, whether these objectives can be achieved depends primarily on the dedication of the individuals; of course, the care and guidance provided by the leaders and the advisers are also very important.

The leaders must do the following: 1) They must thoroughly understand the background and interest of the new students so they can provide the proper guidance for further academic development and for identifying the field of research. By reviewing the needs of the research institute and consulting with the individual and the adviser, the direction of research is determined. Once the direction is determined, it should not be changed lightly. 2) They must not assign the students to do miscellaneous errands and waste their time just because they do not have specific research assignments. 3) They should regularly monitor the students' progress in order to discover and resolve any potential problems. 4) They should provide the students with the proper care in their political and personal lives, and emphasize the principle of dedicating their service to scientific research and modernization; they should encourage the students to establish ambitious goals, and teach them practical skills to achieve these goals.

The advisers have the responsibility of providing direct guidance to the students in their research. They are generally selected by the research institute from its high-level research personnel or from highly qualified mid-level personnel.

Having completed their learning at the information center, the students are examined by the academic committee of the institute; the results of the examination are recorded in the individual files by the research management organizations. Those who pass the examination will become research trainees.

As research trainees, they are assigned to specific research offices where they will work under the direction of mid and high-level personnel. Initially, they may serve as assistants to senior researchers rather than doing independent work. During this period of practical training, they can gradually develop their own capability to do independent research, and leaders of the institute or office should establish a plan to help them advance to the level of research associates within 3 to 4 years. In order to build up their confidence, initially they should be given relatively simple research topics for which results can be easily obtained. Once they have developed the ability to do independent research and to produce results with significant academic or practical value, they are promoted to the rank of research associates.

3012
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PROBLEMS IN TALENT DISTRIBUTION DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND THE MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 7, 1983 pp 35-36

[Article by Gao Yulong [7559 3768 7893], Tianjin Municipal Academy of Sciences: "Several Problems in Connection with the Rational Movement of Talent"]

[Text] The movement of talent can only be effective if it abides by the principle of fixed directional movement. Otherwise, there will be a large outflow of intellectuals from remote areas, and talent distribution and intelligence structures will be imbalanced. This would bring about serious consequences for our cause.

I. The Countermovement of Talent Must Not Continue

Our country has 11 outlying provinces and regions covering 64 percent of our entire land area and having 11 percent of our total population. Several dozen minority peoples reside in these provinces and regions, which have almost a hundred small and intermediate urban areas, possess abundant natural resources and hold an extremely important strategic position. Owing to various factors, especially to the depredations of the "gang of four," scientific and cultural development have been rather slow, and there are few intellectuals in these provinces and regions, which account for only nine percent of the country's scientific and technical [S & T] personnel. At the same time, the standards of these areas' S & T personnel are not very high. In addition, local conditions are limited and the increasingly aged character of intellectuals is a prominent problem. In recent years, local governments have been carrying out the party's policies on intellectuals, doing a great deal of work and making some headway. Still, the exodus of talent is very serious. In Qinghai Province, the outflow-inflow ratio for S & T personnel in 1978 was 20 to 1. In 1980 alone, 2,530 S & T personnel left Guangxi. The city of Huhehaote has lost over 200 S & T personnel in the last 2 years. 90 percent of the S & T personnel in outlying cities came from coastal or central regions and put down roots in the outlands in the 1950's and early 1960's, when conditions were difficult. Now that times are better, these people's resolve to keep these roots is wavering. This countermovement, of course, is closely related to many unhealthy factors in society but is also directly related to the fact that the "search for

talents" has no "fixed direction." In any given period, the number of intellectuals is constant. The more intellectuals there are in one place, the less in another. The greater the talent exodus from outlying provinces and regions, the more backward these areas become economically. This is clearly revealed in the 1980 labor productivity rates presented below.

City	Labor Productivity Rate (10,000 yuan/man/year)	Cost Per Unit Production Value (yuan/yuan)
Shanghai	2.7895	0.2187
Baotou	0.8701	1.7618
Wulumuqi	0.7304	1.0490
Huhehaote	0.8864	0.6785
Shuangyashan	0.4021	1.6280
Shizuishan	0.4688	1.3509
Kashi	0.5612	1.1721
average of 220 cities nationwide	1.2103	0.6435

It can be seen that the rates for outlying provinces and regions are below the national average. If the mass exodus of talent from these areas continues, even larger losses for local economic construction will inevitably result.

Sayings current among the masses, such as "the geese fly south," "the spring rivers flow eastward" and "Zhaojun's complaint," reflect from one angle the seriousness of this countermovement of talent and the dissatisfaction of the broad masses with this phenomenon. We should give this problem ample attention and prevent the trend from developing any further.

II. Some Problems in Implementing a Rational Movement of Talent

Movement of the kind where "flowing water does not stagnate and a door hinge never gets worm-eaten" is an important condition for the existence and development of things. If S & T are to develop, S & T talent must move around. If we are to ensure that this movement is rational, we must strengthen management of this work and make this movement follow the principle of fixed direction from the cities to the villages, from the seacoast to the interior and to outlying regions and from large cities to intermediate and small ones. In this way, we will effect rational distribution and let our limited S & T strengths come more fully into play. To strengthen management of the movement of talent, attention must be paid to work in the following areas.

1. The Fundamental Job in Bringing About a Rational Movement of Talent Is To Ascertain Present Talent Distribution and Intellectual Structures

The distribution of talent and intellectual structures are intimately related to socioeconomic structures. When we adjust economic structures, we must investigate and study whether talent distribution and intellectual structures are appropriate. According to statistics, 866,000 engineers and technicians were employed in the state-owned industrial sector in 1976. Of these, 63.2 percent were engaged in the machinery and metallurgy industries. Since the founding of the nation, 24,400 [?sic] students have graduated from technical colleges and middle schools. Only 70,000, or 3.2 percent, of these graduates have been employed in light industry. At present, for every 10,000 S & T workers in the nation, only 3 work in agriculture. This ratio obviously must be adjusted. We can provide a reliable basis for the rational movement of talent only by ascertaining the distribution of talent and intellectual structures.

2. Planning Adjustments Are an Important Means of Bringing About a Rational Movement of Talent

With the premise that a planned economy is foremost, adjustments in plans are an important means of implementing talent transfers, concentration and employment according to need and of providing for rational movement. We can supplement planning adjustments by implementing versatile mutual assistance and exchange programs and having certain regions and units "solicit talent" as needed.

3. Establishment of Talent Adjustment Structures Provides an Organizational Guarantee for the Rational Movement of Talent

Who is going to unite and organize the five great S & T armies of the nation? Who is going to coordinate talent allocations with reform in the economic structure? We feel that it is imperative that political sections at all levels set up an authoritative talent-management structure whose primary mission would be to conduct investigations and research, suggest planning adjustments, determine adjustment methods and programs for rational talent movement, build bridges and pathways between supply and demand, exercise power over talent management and vigorously engage in political and ideological work in order to ensure the smooth execution of planning adjustments.

4. The Fixing and Promulgation of Appropriate Regulations, Methods and Policies Are Important Conditions That Assure Smooth and Rational Talent Movement

Policies for the rational movement of talent should bring together the needs of our cause and the strengths of individuals in accordance with the special characteristics of intellectuals and let people use their talents and strengths as much as possible. Such policies should join political and ideological work with material benefits. For example, wage policies should bring remuneration into line with duties (or position). Residence

administration regulations should serve the rational movement of talent, and housing distribution should take into account the study, work and lifestyle needs of intellectuals. Those people who make important contributions to the four modernizations should be singled out for advancement (in duties) and promotion (in title). In addition, effective measures should be adopted to encourage intellectuals to move to remote regions, to villages, to the grass-roots level and to where the needs of the four modernizations are greatest. In this way intellectuals can carry out vital specialized work.

5. The Strengthening of Ideological and Political Work is the Key to Rational Movement of Talent

On the one hand, we must continue to overcome our prejudices against intellectuals, further implement party policies on intellectuals, respect intellectuals' status, cherish their labor, understand their suffering and actively create the proper conditions for their work and livelihood. On the other hand, we must strengthen our ideological and political work among intellectuals and teach them to learn from Jiang Zhuying [5592 4639 5391] and Luo Jianfu [5012 0256 1133], to have ambitious revolutionary ideals, to embrace the four modernizations as their own mission, to foster take-charge spirit and brave devotion and to contribute all their intellect and talent freely and unconditionally to the homeland. Only by accomplishing our work in these two areas can we fully mobilize intellectuals' socialist initiative and enable the movement of talent to play its proper role.

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ORGANIZATION, ROLE OF BRAIN TRUSTS ANALYZED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 10 May 83 pp 7-9

[Article by Sui Qiren [7131 0796 0088], Shanghai Housing Construction General Company: "The Organization and Roles of Scientific and Technological Brain Trusts"]

[Text] One prominent feature of modern society is that science is growing ever more socialized and society ever more scientific. Therefore, no talented leader or scientist can reach correct and satisfactory decisions on his own. We must organize efficient advisory contingents, converging a hundred streams into the sea and pooling the collective wisdom into decisions.

The emergence of the scientific and technological brain trust not only is an urgency of the times, but also possesses the potential for modern scientific and technological development. The reasons are as follows: 1. The rapid development of modern science and technology provides extremely rich information. The tremendous quantity and high reliability are unseen in the past. By means of such intellectual "capital," mankind will greatly lessen the chances of mistakes and increase the certainty of success. 2. The practice of modern science and technology has created a group of talents with intelligent minds. According to foreign statistics, the number of scientists doubles every 10 to 15 years, including both experts and specialists in individual fields and all-round talents with wide ranges of knowledge and familiar with several fields. 3. Modern science and technology have also created the material means for modernization and provided powerful tools for full intellectual development. Such advanced technologies as electronic computers, modern communication equipment, sound recording, image recording, miniaturization, and duplication have all provided highly efficient means for the work of the brain trust. 4. The superiority of the socialist system has opened the way and created favorable conditions for the development of intellectual resources.

Forms of the Brain Trust

Most countries in the modern world have reaped gigantic benefits from developing their intellectual resources, thereby providing a powerful impetus for the birth and development of the brain trust. The mechanisms of the brain trust in developed countries are generally as follows:

1. Permanent Organization

The scientific and technological conference of the Japanese government, for instance, is a permanent brain trust serving exclusively as an advisory organ to the cabinet. When it comes to major decisions affecting national economic and social developments, the government, instead of making hasty decisions, first hands them over to the scientific and technological conference composed of experts in all fields for repeated investigation and deliberation, and the conference will then submit multiple measures and plans for selection by the cabinet. The famous "Advisory No 5 Solution" and "Advisory No 6 Solution" of the seventies provided detailed analyses and expositions of the developmental trends, service focuses, long-range prospects and concrete measures of Japan's science and technology, the developmental plans of the national economy, and the possible unforeseen circumstances and countermeasures.

2. Pro Tem Organization

It is difficult for permanent brain trust organizations to render advice on special subjects which involve broad ranges of knowledge. Therefore, pro tem organizations have emerged. In some American universities, many subjects and specialities which seem unrelated are placed in the same institution. Physics and linguistics, for instance, are found in the same school; the departments of chemistry and architecture are adjacent to each other; even art and mathematics are in one school. Whenever subjects with the same target need to be studied, experts of different academic fields promptly gather together. They come when summoned, take action upon arrival, and depart upon conclusion.

3. By Contract and Agreement

The decision makers specify the quality, standards and cost of a project beforehand, and invite the convener of a brain trust to undertake it. All concrete matters are handled by the convener, and all the decision makers ask for is a satisfactory result.

4. Inviting Bids or Soliciting Manuscripts

The unit needing intellectual service sends out an announcement on its concrete requirements and the amount to be paid by it, and openly solicits responses. The interested brain trust organizations or individuals submit their responses and conditions in writing for selection by the unit. The solicitation activities held by Shanghai in 1981 for plans to build a new Shanghai belonged in this category.

5. Mass Organization

Often some mass organizations rich in intellectual power scattered in the various corners of society do not belong to any decision making organ, advisory branch or research unit. The clubs in foreign countries formed to exploit intellectual power are not recreational in nature, but mainly focus on studying problems and can often produce academic results. The "retired engineers associations" voluntarily organized in some cities in China not long ago should receive support and encouragement.

6. Feasible Suggestions

Written statements of opinions, feasible suggestions are an effective means to exploit the intelligence of individuals. Vigorously promoting feasible suggestions Japan's Toyota automobile corporation installed many little wooden suggestion boxes which are regularly collected by specially assigned persons, and the authors are rewarded according to the value and level of their suggestions. Many knowledgeable people among the masses are often not employed according to their skills, and decision makers absolutely must not miss their valuable opinions. The letter from Einstein to U.S. President Roosevelt enabled America to be the first to possess the atom bomb.

Naturally, the development of intelligence is not limited to the above forms. With the greater integration of science and technology with economics and society, more forms and channels to exploit intellectual power will be created.

Roles of the Brain Trust

A decision making organ often has a commensurate affiliated brain trust. The latter enables the decision makers to broaden their minds. It has become a feature of the modern system. An isolated "leadership headquarters" is unable to implement the correct decisions and perform the commanding functions.

Scientific and technological brain trusts play the following roles:

1. Providing Bases and Plans to the Decision Makers

Before a decision is made, the task of the brain trust is to propose a series of bases and plans on whether, when and how to proceed in the qualitative and quantitative aspects. After a decision is made, it helps the decision makers correctly and promptly obtain information feedbacks and make program adjustments and, in case of unforeseen circumstances, promptly produce emergency remedial measures. The launching of satellites by the Soviet Union in the mid and late fifties evoked a strong reaction from the United States and the entire capitalist world. What should the United States do? The president called a series of meetings of the brain

trust and drafted the famous "Apollo" moon landing plan. After many discussions, debates, computations, comparisons and selections among the various programs, the "moon orbit" program was finally adopted, and the result was successful, thereby fully demonstrating the role and power of the scientific and technological brain trust.

2. Providing Information and Intelligence to the Decision Makers

As the decision makers are limited in energy and contact, it is impossible for them to promptly understand the situations in great detail. Thus, the brain trust must make up the deficiency by verifying and comprehensively analyzing the information collected and summarizing it into a brief report, so that the decision makers can grasp the situation in a short time and gain a picture in their minds.

3. Providing Measures and Plans for Popularizing Application of Achievements

Popularization must be given consideration at the time of manufacturing, and production must follow as soon as possible. We must give consideration to popularizing at time of manufacturing, plunge into production as soon as possible, select the rational technological processes and make scientific and technological achievements serve society promptly. When America's first atom bomb was still on the drawing board, the brain trust concerned had already selected the large B-29 bomber to drop it (its size was determined according to the craft), and an airforce unit had already been organized and trained on Tinian Island.

4. Assisting Decision Makers in Forecasting

Generally speaking, the decision makers often devote most of their energy on the urgent current problems, and do not give much consideration to future tendencies. However, as "forecast leads to success, and the lack of it to failure," the brain trust must shoulder the task.

The insight and thinking of the brain trust are, on the one hand, "synchronized" with the decision makers and, on the other, "advanced." Problems which have not been considered, or carefully considered, by the decision makers are given early detailed attention by the brain trust, in order to strive for the initiative and avoid passivity.

Personnel Composition of the Brain Trust

The personnel composition of the brain trust determines its efficacy. The appropriate selection and matching of different types of talents greatly increase the effectiveness of the collective. From historical experiences at home and abroad, a brain trust should have the following types of personnel.

1. Specialization as well as Broad Range of Knowledge and Versality

The personnel do not have to be famous authorities in special fields, but must be expert in certain specializations and possess good knowledge in other fields.

2. Vigorous Creative Spirit

The mission of the brain trust is not to come up with outdated plans and obsolete methods, but to produce effective new ideas. Therefore, those following the old conventions and fearing to venture beyond the boundaries are not suitable as members of the brain trust. Only those rich in creative spirit can succeed by surprise moves and open up new phases.

3. Meticulous Thinking

A person must be able to think maturely and express his ideas accurately and concisely. He must be skillful in analyzing, synthesizing and summarizing the views of others and in making judgements and drawing inferences. He must be expert at assimilating the essence of the ideas of others and benefiting from their wisdom.

4. Necessary Side-Talents

Like watching chess games, some people, though unable to see the overall picture, can indeed make sharp moves, thereby changing the entire situation. Others, though unable to produce ideas in sets, can find the faults in others' ideas and hit the point. They also constitute a sort of talent.

5. Ability in Seeking Advice

Due to organizational limitations, it is impossible for a brain trust to include all specialists. Under many conditions, members of the brain trust must seek advice from outside experts. Besides an attitude of humility, they must possess the skills of reporters and find knowledge and information from the outside.

6. Courage in Seeking and Upholding Truth

In developing intellectual power, the issue of leader and follower between the members of the brain trust and the decision makers, and the principle of "minority obeying the majority" among the members themselves do not exist. The right and wrong are tested by practice. As long as a member is responsible to facts and to truth, he may disagree with the leader or the majority. If, instead of upholding principles, a member tries to please others and watches their moods, the brain trust will lose its meaning of existence.

On the march toward the four modernizations today, not many of our decision making and commanding personnel of the various levels are expert in

science and technology and familiar with business management. Thus emerges a solemn issue: While vigorously studying science and technology, they need capable and reliable advisers and assistants. By means of exploiting the intellectual power in society, the scientific and technological brain trust will make the party leaders more scientific and more foresighted, and provide a firm foundation for the decisions of all kinds in the four modernization construction.

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CURRENT PROBLEMS OF SCIENCE, TECHNOLOGY RANKS

Beijing JINGJI RIBAO in Chinese 9 Jan 84 p 2

[Article: Problems of the Present State and Existence of China's Science and Technology Contingent]

[Text] China's science and technology contingent is beset with many problems which urgently demand a solution, for instance, poor distribution, irrational structure, inappropriate specializations for jobs in hand, lack of highly qualified personnel, age , etc.

According to statistics at the end of October 1982, the technical contingent in units owned by the people throughout the nation was 9.08 million persons. Among these, 6.26 million worked in the natural sciences, accounting for 68.94 percent of the entire contingent, and 2.82 million, or 31.06 percent, worked in social sciences. The technical contingent in units owned by collectives at the county level or below numbered 370,000. Added together, the total was less than 10 million.

Low Scientific and Educational Level

In the entire contingent, 3.55 million had graduated from universities, and institutions of higher education, accounting for 39.4 percent. Those from polytechnic schools account for 37.3 percent, from senior middle schools 9.3 percent and from junior middle schools or of lower general educational level account for 14 percent. In the social sciences, the situation is even more conspicuous. Those of junior middle school or lower general educational level account for 26 percent (including 40 percent finance, accounting, statistical and similar personnel).

Lack of Highly Qualified Persons

Those with high professional-technical titles number 70,000, and account for 0.78 percent of the entire contingent. Among these, 60,000 worked in the natural sciences and 10,000 in the social sciences. The agricultural system had only 441 senior agronomists, accounting for 0.12 percent of its contingent of 360,000 persons. In the six remote border provinces of Xizang, Xinjiang, Qinghai, Gansu, Ningxia and Inner Mongolia, there are only 2,583 persons with advanced professional titles, of these only 60 persons are in Xizang.

Age Problem of Medium-Ranking Qualified Personnel

The average age of persons with professional titles of medium rank is 45. According to forecasts, by 1990 the proportion of persons with professional titles of medium rank aged 36-45 will decline to about 12 percent and create a crisis as far as availability of middle-aged technical core personnel is concerned.

The average age of personnel with professional titles of high rank is 55.6. Among these, persons of 56 years or over account for 53 percent, those 61 years or older account for 30.5 percent and those 45 years or younger account for only 2 percent; persons under 35 years of age in this category number only 10 throughout the whole country.

Poor Distribution

This manifests itself now conspicuously in the following: there is an extreme shortage of personnel in areas designated as national priorities such as agriculture, consumer goods industry, energy, communications, transportation and business management. For instance, in agriculture only 800,000 persons have undergone technical training, but at present only 360,000 of them remain, and only 50,000 actually serve in the frontline of promoting technical progress. For all the 60,000 communes in the country the average is even less than one person per commune.

Scientific and technological personnel in the coal mining industry account for about 1 percent of all its staff and workers. In the petroleum industry, especially in offshore petroleum exploration, there is also a great shortage of personnel. Among business management personnel, about 70 percent do not possess the prescribed educational background. Among this category, less than 200 throughout the whole country are advanced economists, statisticians and accountants. If this situation is allowed to continue and the training of qualified personnel is not speeded up, the chances of "winning our battle" will be lost, with truly disastrous consequences.

Irrational Internal Structure

This manifests itself in two respects: one is the imbalance in the proportionate structure of our personnel, especially in the large and old units where there is a large number of medium-ranking core personnel and a shortage of lower ranking qualified personnel. For instance, at Qinghua University the proportion of high, medium and low-ranking personnel is 2:6:2. In the Shanghai branch of the Academy of Sciences the ratio is 2:7:1 (in 1965 it was 2:3:5). The other point is that specialized use of specialized trades and common use of specialized trades do not form a harmonious whole, there is too much specialized use and too little common use.

The irrational use is the most conspicuous problem of the present waste of talents. The crucial reason is that talents are hampered by the ownership system practiced by units and departments. They cannot circulate reasonably.

Some units where tasks are obviously insufficient, still refuse all adjustments, refuse to release personnel and follow the negative principle of "not releasing a man means not to have to train a new one."

In the remote border regions, there is urgent need for talent in the villages, in light industry, in energy and in collective enterprises, but it is difficult to have qualified men go there. The use of talent for trivial tasks, or on no tasks at all, is still rampant in a serious way.

Judging by these conditions, it is a matter of extreme urgency to work out an effective plan for the overall problem of qualified personnel.

9808
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STATE SCIENCE, TECHNOLOGY BODY OUTLINES POLICY

OW170928 Beijing XINHUA in English 0911 GMT 17 Dec 83

[Text] Beijing, 17 Dec (XINHUA)--There is no such thing as "ideological contamination" in natural science and technology, the State Science and Technology Commission stated here today.

This was one of six policy guidelines for science and technology approved by the State Council. These guidelines were read out by Zhao Dongwan, vice-minister of the commission, at the current national science and technology work conference. Zhao explained, the principles were issued to encourage scientists and technicians to emancipate their minds and create a general respect for knowledge in Chinese society.

The Guidelines:

1. Scientists and technicians should be encouraged to study modern technology and scientific results from anywhere in the world. Natural science and technology have no class character. New, modern results should not be treated as "unorthodox opinions" or "bourgeois sugarcoated bullets."

2. Many frontier sciences are emerging constantly between the natural and social sciences. They should be conscientiously studied and developed. It is not right to refuse or be afraid to have contact with them, or to totally affirm or negate them.

3. Scientists and technicians should be encouraged to emancipate their minds and speak out freely in discussing scientific problems or feasibility research on major projects. Researchers who disagree with their leaders should not be treated as being politically out of step with the communist party.

4. It is beneficial and helpful to the reform of China's scientific system to study and compare both Chinese and foreign experience in scientific policies and management. It is not right to refuse to study and make use of these experiences only because foreign social systems are different from China's.

5. Free discussions should be advocated in academic fields. Researchers should be allowed to freely choose their topics and research partners in addition to those assigned by the state. Experiments on free movements of intellectuals between work units should also be allowed. These should not be labeled "bourgeois liberalism."

6. Mistakes, non-perfection or even failure are inevitable in scientific research and experiments. These problems should be solved by the necessary criticism and self-criticism. In natural science and technology, there is no such thing as "ideological contamination."

CSO: 4010/39

EXCESSIVE NON-S&T PERSONNEL IN RESEARCH ORGANIZATIONS CRITICIZED

Beijing RENMIN RIBAO in Chinese 11 Sep 83 p 3

[Article by staff reporter Zhu Ming [2612 2494]: "Large Numbers of Non-S&T Personnel Must Not Be Allowed to Pour into Scientific Research Organizations"]

[Text] During a national symposium held not long ago in Nanning on the reform and reorganization of some scientific research organizations, attention was drawn to the serious problem of the flood of nonscientific and nontechnical [non-S&T] personnel into scientific research organizations in some locations and departments in recent years following the development of scientific research and the increase and expansion of scientific research organizations. Based on the statistics of Heilongjiang, from 1960 to the present, S&T personnel in the province's scientific research organizations have only increased by 13 percent. Yet, non-S&T personnel in these organizations have increased by nearly 4 times. The 291 scientific research organizations in the Guangxi Zhuang Autonomous Region have a total staff of 14,595 persons, of which only 4,967, or about a third, are S&T personnel.

No clear regulation exists in our country on the ratio of various types of personnel for scientific research organizations. It is also very difficult to define a concrete guideline. This is because the requirements for administrative personnel, especially ordinary laborers, vary among the different types of scientific research academies and institutes. However, similar scientific research organizations differ greatly in whether or not they control the influx of non-S&T personnel. For instance, the Guangxi Research Institute for the Prevention of Parasitic Diseases has a total of 67 people, of which 62 are S&T personnel and 5 are administrative personnel (4 cadres and 1 laborer). The ratio between S&T personnel and administrative personnel is 12 to 1. Yet, in another, similar research institute in Guangxi, where the total number of personnel is 136, there are 58 administrative personnel. The ratio between S&T personnel and administrative personnel is 3 to 2. The latter institute has many more administrative personnel than does the former.

S&T personnel should comprise the main bodies of scientific research organizations (excluding experimental plants and farms under the scientific research academies and institutes). Administrative management cadres and laborers should be provided only when necessary. Otherwise, these organizations' names would fall short of their realities, and they would become administrative organizations.

As this reporter understands it, because of the large influx of non-S&T personnel, many serious problems have emerged in many scientific research organizations. This personnel has occupied much of the quota for cadres and weakened research strength. Some provinces believe that 40 percent of their research institutes do not function properly and that the large influx of non-S&T personnel is one of the reasons. An excessive number of non-S&T personnel will also create a situation where the organization becomes too fat and overstaffed, inflexible for management and low in efficiency. Because of an excessive number of administrative personnel and overly fine division of labor, many support activities are actually left undone. Of even greater seriousness is the fact that many non-S&T personnel have nothing to do all day. Furthermore, they do not understand the characteristics and requirements of scientific research work, and yet they like to specially pick the faults of S&T personnel, creating obstacles and causing problems in scientific research work. However, when the time comes for housing allocation and disbursement of expenses for books and newspapers, these people put their hands out one after another. All this is seriously affecting the normal development of scientific research work and the implementation of the policy concerning intellectuals.

Why has a large number of non-S&T personnel poured into scientific research organizations? The reasons are numerous. However, the principal ones are four. The first is blind staff building. For instance, in one province, there are now 143 industrial scientific research institutes, but 28 of them have only 1 or 2 engineers. However, the administrative areas have long been very completely staffed, and this staffing is also very large. Second, among some people, scientific research organizations are very popular today. Working conditions in scientific research organizations are both stable and comfortable. Thus, some people try to find every way possible to travel the back door and transfer their kids and relatives into these organizations. Third, the scientific research institutes are treated like employment houses. As long as there is a personnel quota, management departments and bureaus stuff it with people awaiting employment in their departments. Fourth, scientific research organizations do not have authority over personnel, and some assigning departments disregard work requirements and simply assign to these organizations large numbers of ex-servicemen awaiting transfer to civilian work who have no technical knowledge or even much education.

Many people responsible for the operations of scientific research organizations and many group chiefs for research subjects state: "At present, we have too few people that we need and too many that we do not need. We cannot get people that we need, but those we do not need come in large numbers. The structural ratio of talented people is out of balance, which has created very great difficulties in scientific research." They suggest: 1. Immediately prevent non-S&T personnel from entering into the work of scientific research organizations. In assigning cadres, the related departments of the state must fully consider the strongly specialized, technical characteristic of scientific research organizations and should not arbitrarily assign non-S&T personnel. 2. Stress readjustment of superfluous non-S&T personnel. Various levels of labor personnel departments must give this their active support. 3. Those who assign non-S&T personnel with improper methods must be sternly treated. From now on, units and individuals who assign non-S&T personnel and ignore work requirements must be investigated to affix responsibilities.

5974
CSO: 4008/2

SCIENCE, TECHNOLOGY PERSONNEL NEEDS OUTLINED

Beijing GUANGMING RIBAO in Chinese 8 Dec 83 p 2

[Article by Yang Youqi [2799 0645 7784]: "What Kind of Engineers and Technicians Do We Need?"]

[Text] Currently, most of the S&T personnel in China are engineers and technicians. The question of how best to manage and use our existing engineers and technicians and how to train more of them is one of the central problems of the four modernizations. Based on his investigations and experiences from a period of training abroad, the author will attempt to inquire into the features of the qualifications of engineers and technicians and will present some superficial viewpoints on questions in our work for research and discussion with others.

Based on the professional role of engineers in society, the esteemed former president of America's Massachusetts Institute of Technology, Dr Brown, divides engineers into four main groups: scientists, innovators and inventors, worksite engineering specialists, and administrative and planning engineers. His views have gained widespread endorsement. I will combine China's concrete experiences below for analysis.

The first type of engineer and technician may be called engineering scientists. This refers to those engineers who have a talent for abstract thought. They are good at discovering problems in existing systems and equipment, and are adept at using new patterns to link together several seemingly incoherent concepts in order to obtain the appropriate engineering goals. Their work is basically one of creative intellect, and their main difference from pure scientists is that they seek applications and do not explore the unknown. Their achievements and contributions are viewpoints and ideas, not new products. Much like scientists, however, they do have a solid theoretical foundation.

This type of talent is hard to come by. They can be called the "thinkers" of industrial departments. They have high status in large companies in capitalist countries, or they work in brain trust companies and in consulting and advisory companies (such as America's famous Rand Corporation). Because they must compete to weed through the old and bring forth new in a company or even in a nation in order to maintain a leading position in

technology, it is extremely important in principle for them to seek out completely new directions. These directions are not just theoretical fantasies, but must be practical for engineering technology. This requires a group of brain trust people who can provide counsel on S&T development strategies. Their achievements must not only provide instant economic results, but must also have profound influences on the future.

It has been difficult to establish a base of this type of talented people in the industrial departments of our country for a long period. Because they are good at theoretical thinking and looking into the future, and only provide viewpoints, they were often accused of "theoretical detachment from reality" because of the "left" ideological line a few years ago. Before leading bodies at all levels became specialized and fully knowledgeable, it was often very difficult for them to find a "close friend" in their own unit. On the other hand, because of the current lack of an ideology of independently creating S&T development strategies in our industrial departments, the major part of the so-called developments have already been completed or work is being done on them in foreign countries. There is no competitiveness between departments, and it appears that it does not matter much to industrial departments if they have this type of talented people or not.

However, China is a large country with a population of 1 billion. We cannot be satisfied with "mechanically copying foreigners," but should make major contributions to mankind. For this reason, we must especially encourage invention based on original ideas and viewpoints. Rewards should be given for any new viewpoints or discoveries that are of value. We should eliminate rigid systems of seniority and hierarchy, and break the rules to promote those S&T personnel who successfully open up new areas of technology.

The second group can be called innovators and inventors. This refers to those engineers who cleverly apply contemporary knowledge to discover or construct new engineering systems. They are directors and innovators. Their primary role is to discover, design, and fabricate real and useful things. Their main consideration is feasibility and economic practicality in engineering terms. Their work is closely related to the "strategic engineers" of type 1, but there are differences. In view of the fact that they usually work in development and testing laboratories, design and construction departments, or manufacturing departments, this requires them to be competitive both in scientific knowledge and in engineering knowledge.

Because this group of talented people discover, design or create real things, their efficacy can be seen immediately. It is therefore relatively easy for them to be acknowledged by others. Those talented people who have been able to gain promotions despite regulations in the past several years are mostly of this type. There is no doubt that people with these qualifications are extremely important, and are a very dynamic force in industrial departments. It must be noted, however, that this is not the only type of talented people.

The third type of qualified engineers and technicians are specialists who safeguard operations in industrial departments, and may be called worksite engineering specialists. This refers to engineering specialists who work in the installation, operation and protection of complex machinery and engineering systems, and they can be called the caretakers of modern technology. On the surface, the work of these engineers is not as creative as those in groups 1 and 2, so it is not easy for them to achieve recognition. They are, however, extremely important for our modernized production. Despite the fact that they do not publish articles, they should be given high-level technical titles at proper times. Otherwise, qualified people will automatically move into group 2. This is extremely bad for strengthening the first line of production.

The fourth type of engineers and technicians can be called technical planning and administration personnel. This refers to the fact that their activities occur primarily against the backdrop of technological policies. They are on the borderline with translators and people who promote technological progress. Their special characteristics are: one, that they have extensive knowledge, but the degree of their familiarity with their specialty does not have to be as great as groups 1, 2 or 3; two, that they have a relatively full understanding of state principles and policies; and three, that they do more research on the areas which are related to their planning or management. There is no doubt that this type of engineer plays an extremely important role. The level of their work frequently determines the effectiveness of the labor of a large group of other engineers and technicians.

There is a special lack of this type of qualified people in China at present. Because they usually do not present written articles or direct economic results, however, many people are not content with this type of post. The result is a continuing loss of this type of qualified people who are already in extremely short supply. Consequently, the phenomenon has resulted in people being sent to administrative departments who are not suited for front line scientific research, design or education. This is equivalent to failure to acknowledge the existence of or need for qualified administrative personnel. The disastrous consequences of this deviation have already been and will continue to be obvious in our work for a long time.

Only by clearly knowing what type of qualified engineering personnel are needed will we be able to consciously discover and train different types of qualified people, and to rationally utilize different types of qualified people. Only then will it be possible to establish a new system for evaluating these intellectuals. Since there are differences in the characteristics of different types of qualified personnel, the standards for evaluation should of course be different. Uniform requirements for presenting articles or contributing economic results as the basis for universal promotion of titles are bound to be superficial. We should clearly propose different requirements and evaluation standards for different types of personnel to permit the proportional and healthy growth of qualified personnel.

12539
CSO: 4008/90

SUPPORT FOR SCIENTIFIC AND TECHNICAL PERSONNEL STRESSED

Financial Support by CAS

Beijing RENMIN RIBAO in Chinese 25 Aug 83 p 3

[Article: "Chinese Academy of Sciences Allocates Funds for Supporting Selected Young and Middle-Age Key Scientific and Technical Personnel"]

[Text] According to KEXUE BAO, the Chinese Academy of Sciences has decided to allocate 5 percent of its scientific research funds for supporting a number of selected young and middle-age key scientific and technical personnel. Recently, the biology department of the academy appropriated 1.73 million yuan mainly to be used as financial aid for 40 outstanding young and middle-age scientists and technicians in research work.

These 40 scientists and technicians were recommended by various research institutes and selected by the biology department after careful examination. Most of them are key professionals who have achieved important success in recent scientific research projects, and are now engaged in important research work without the necessary facilities; and 27 of them have studied abroad. Financial aid in amounts of 10,000-100,000 yuan were granted according to their actual needs and working conditions. Hong Guofan [3163 0948 5672] of the Shanghai Biochemistry Institute, who recently returned from England after advanced study and made great achievements in nucleic acid research, received a grant of 100,000 yuan on this occasion.

Advanced Training for In-Service Personnel

Beijing RENMIN RIBAO in Chinese 28 Aug 83 p 3

[Article by Lin Shouping [2651 1108 1456] of Beijing Municipal Association of Science and Technology: "The Need for In-Service Scientific and Technical Personnel To Be Intellectually Updated Should be Highly Regarded"]

[Text] Because of the rapid development of modern science and technology, many countries have, in the past 10 years and more, encouraged "continued education" in order to help their scientific and technical personnel acquire up-to-date knowledge. What these personnel have learned in school can only serve as the foundation, and, more important still, their achievements and

contributions are decided by whether or not they can continue to study while being engaged in practical work, acquire new knowledge, and continue to raise their intellectual standards.

In view of the four modernization drive, our scientific and technical personnel are in urgent need of up-to-date knowledge. To them, this is an important personal problem which is in urgent need of solution while implementing the policy on intellectuals. To our understanding, the need for "continued education" for the scientific and technical personnel is mainly based on the following five considerations:

1. The need to study new sciences and technologies. For example, although electronic computers are widely used in foreign countries, our scientific and technical personnel had no opportunity to learn about them in school. Some experts have proposed that we should launch a "literacy" campaign among the scientific and technical personnel for computers. Again, our backward technology of testing is one of the important causes for our failure to improve the quality of our products, while development in this field has been very rapid abroad in recent years, and many scientists and technicians ardently desire to master the new testing techniques.

2. The need for advanced study in foreign languages.

3. The need to study economics and management science. For many years, engineering students in our institutes of higher learning did not study economics or business management. After the announcement by the Party Central Committee that "economic construction should rely on science and technology, while science and technology should be orientated to economic construction," the broad masses of scientists and technicians felt the urgent need to learn about economics and to master the knowledge of management. Recently, some scientific and technical personnel have been appointed to leading positions, and their need to study the science of management is more urgent than ever.

4. The need to study related subjects. Along with the development of modern science and technology, different academic subjects have become interwoven, and many scientific and technical cadres have felt that their fields of knowledge are too narrow, and that they must study the related subjects. For example, with the tendency of a combined development of mechanical and electronic development, more than approximately one half of mechanical engineers now want to study electronics.

5. The need to brush up on basic theories. After a long practice, many scientists and technicians now feel that they must have a solid theoretical foundation before they can advance professionally.

While investigating in Beijing Municipality on the implementation of the policy on intellectuals last year, we noticed from our observation on more than 30 units that the instructions from the former scientific and technological cadres bureau of the State Council to the effect that scientific and technological cadres above the rank of assistant research workers and

engineers should be given advanced training for 3-6 months every 3 years had hardly been carried out. These cadres are now full of anxiety about it, saying: "If we only keep on milking instead of feeding, there will finally be a crisis in the scientific and technological ranks."

To promote "continued education" for the scientific and technical personnel, the first requirement is that the leaders concerned must have a better understanding of the situation. At present, many leading cadres are busy with their immediate work and lack a long-term point of view. The training of personnel and the immediate need for production are thus set against each other. These leading cadres can only see the pressure of work and cannot spare any scientific and technical personnel for advanced training. Some cadres may have begun to recognize the need for "education"; however, they are usually concerned only with the need of people with low cultural and technical standards to study, but not the same need of scientists and technicians, especially the backbone scientific and technical personnel. In many units at present, education for in-service scientific and technical personnel has become a weak link in the program of education for workers and staff members. Facts have proved that if the leadership of any unit is genuinely concerned, then this unit will be able to promote "continued education." For example, the scientific and technical personnel of a research institute wanted to study electronic computers, but the leadership insisted that nobody could be spared because of the pressure of work. One of these workers temporarily put aside the work he had on hand in order to study, but brought his computing job with him to be used for practical experiment in the class. After 2 months of study, his computing job, formerly requiring 3 months, was completed in only 2 hours. The leadership was moved and said: "It is true that sharpening the knife will help the woodcutter in his work."

Second, we must reform our administration over scientific and technical cadres, further eliminate egalitarianism in the use of and remunerations for personnel, and encourage the scientific and technical personnel to study and advance, as a matter of policy.

Third, the government and people in all circles in the society should combine their efforts to make "continued education" a success. The educational departments should list the "continued education" for scientists and technicians as an important component of the educational undertaking, provide more active leadership, work out an overall plan, and solve the problems with funds, teachers' qualification, and training organizations. They should also use foreign experiences for reference, and then, proceeding from our national conditions, work out the relevant statutes for "continued education," so that "continued education" will be incorporated in the entire educational system. The enthusiasm of all fields should be aroused so as to form a multichannel and multilevel scientific and technical training network with the government, mass organizations, educational departments and enterprises participating. Based on our practical experiences in the past several years, stress should be laid on the establishment of community training centers, while extensively launching the "continued education" campaign. By this means, we will be able to solve the problems encountered in conducting

"small and complete" training sporadically by individual units and help raise the standard of training and improve its effects. The Beijing Municipal Association of Science and Technology has set up an advanced training school in science and technology as a training center for the backbone scientific and technical elements throughout the municipality. It has produced excellent results and is lauded as the "refueling station" for the updating of knowledge.

9411
CSO: 4008/213

SCIENCE FUND GRANTS PROMOTE REFORM OF RESEARCH MANAGEMENT

Beijing RENMIN RIBAO in Chinese 12 Jan 84 p 3

[Article by Chen Zujia [7115 4809 3946] and Chen Dong [7115 2639]: "The Chinese Academy of Science's Science Fund Has Begun to Play a Role; An Effective Attempt to Reform Management of Scientific Research; In the Past 2 Years Over 1,400 Projects Have Been Selected for Funding"]

[Text] The Science Fund Committee of the Chinese Academy of Sciences disclosed in a report to the fifth conference of the Scientific Council that from 1982 to November 1983 funding grants totaling 69.42 million yuan were approved for 1,453 research projects. The science fund is beginning to play a role in the reform of research management, mobilizing technicians' initiative, tapping the potential of science and technology, promoting a reasonable amount of competition in research work and raising the level and efficiency of that work.

The establishment of the Science Fund Committee was proposed by 89 members of the fourth conference of the Scientific Council and effected in 1982 following approval by the State Council. The committee and the departmental fund review agencies are all comprised of council members, and in the last 2 years 12,500 council members and experts have participated in review work. The science fund has become an important route through which scientists participate in research management.

For a long time, China's research funds were distributed along sectoral lines and divvied up according to unit "departmentalization." Due to sectoral segregation, many important research topics that were peripheral or straddled several sectors were unable to obtain funding and thus were never implemented. Some technicians were constantly vexed by this state of affairs, in which they could never do what they wanted and which they could not avoid. These conditions are most pronounced in institutions of higher education and among middle-aged technicians. The establishment of the science fund has promoted many important research projects.

In accordance with the principle of selecting the best, grants from the science fund have been made primarily to those basic S & T projects that help resolve the urgent problems of economic development and that meet the needs of S & T development. Applied research projects (primarily consisting

of basic applied research work) received 72 percent of the grants approved in 1982 and 89 percent in 1983.

The science fund approval process also takes note of the needs of the entire nation. Given similar conditions, preference is given to technicians who are middle-aged or from remote areas. In the last 2 years, about 90 percent of the academy's science fund grants have gone to unaffiliated institutions of higher education and research units belonging to industry, communications, agriculture, medicine, defense and localities. The projects funded in 1983 involved 429 holders of doctorate and master's degrees, and 67 percent of the applicants for these projects were middle-aged technicians. The Biology Department also experimented with small grants of less than 5,000 yuan in order to assist important exploratory research by middle-aged technicians under 45 years old.

12431
CSO: 4008/109

VIEWS OF RESEARCH PERSONNEL ON CURRENT REFORM OF SCIENTIFIC RESEARCH

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 8, 1983 pp 10-12

[Article by Gu Jiugang [7357 0046 4845]]

[Text] The Shanghai Laser Research Institute is one research unit designated for test reform. Through personnel mobilization, learning, and discussion, we began formulating a plan for reform. In an effort to monitor the current thinking of the general public, to understand the demands and wishes of the research personnel, to analyze today's existing problems, to establish a comprehensive reform plan, and to improve future efforts, we conducted a survey among the personnel of the Institute by asking them 12 selected questions using the Delphi method.

Based on 157 returns, we summarize the survey results as follows:

Question 1: What is your view on the test reform program at this Institute?

Reply	Highly Interested	Indifferent	Not Interested	Do Not Understand	Other
Percent	28.0	44.6	14.0	7.6	5.8

A fairly large percentage of the personnel (44.6 percent) gave the reply "Indifferent." The primary reason for this is probably due to the lack of positive results from the 1979 "power expansion" test program; other organizations which did not participate in the program essentially achieved the same result. With regard to the benefits that can be derived from this reform, it is still difficult to predict at this time.

The fact that 28 percent of the replies were in the "Highly Interested" category, and 21.6 percent were in the "Not Interested" and "Do Not Understand" categories is considered normal.

As part of the reform, we have implemented a method of evaluating an individual's output in his research work. First, based on the job category and the type of research personnel, an expected annual level of effort is computed. Then, for each research task, a quantitative estimate of the required

number of personnel, the expected completion time (months), and the degree of difficulty is made, from which a level of effort index is calculated: $F = \frac{K\,W}{P_s}$, where P_s is the "number of personnel capable to perform the task," K is the coefficient of difficulty, and W is the specified level of effort (man-months) for the particular research task. By comparing the level of effort index for each research task, we can adjust the task and the number of personnel; finally, awards are given according to the actual value of F.

Question 2: What is your view on the method of quantitative evaluation of research output?

Reply	For	Indifferent	Against	Do Not Understand	Other
Percent	24.2	39.5	14.0	13.4	8.9

The reason that 39.5 percent of the replies were "Indifferent" is probably due to the lack of evidence of actual results from this newly proposed method.

The reasons given by those who marked "Against" on the survey form are as follows: 1) Since scientific research is to explore the unknown, it is difficult to compare one research topic with another; even if an assessment of the level of effort, the degree of difficulty, and the ability of personnel assigned to each task is provided by the academic committee, it is not likely to be accurate because of the lack of objective standards. 2) For jobs that require mental labor, it is not appropriate to use a simple evaluation procedure based on specified level of effort. 3) An award system established on such an unreliable foundation is not likely to be fair. 4) Once the quantitative evaluation procedure is implemented, the work load is likely to increase; but the wages of research personnel are so low that they always worry about making ends meet, and their physical conditions are likely to deteriorate under the constant stress. 5) It is a nuisance to spend a great deal of energy and time on some evaluation work which has nothing to do with scientific research.

Question 3: What is your view on financial planning and evaluation for each task?

Reply	For	Indifferent	Against	Do Not Understand	Other
Percent	34.4	38.2	5.1	8.9	13.4

Question 4: Do you think the new award system will encourage scientific research?

Reply	Yes	Have Little Effect	No	Do Not Understand	Other
Percent	8.3	47.1	24.2	11.5	8.9

Most research personnel are of the opinion that since it is difficult to evaluate scientific research work, an award system based on this new evaluation method cannot be very effective in promoting scientific research. The number of replies which indicated that the new award system will have little or no encouraging effect on scientific research was 71.3 percent.

During the organizational reform within this Institute, we insisted on division of efforts between the Party and the Administration, and we changed the internal organization accordingly; we also enhance the activities in research, technical service, and test production. As a consequence, a substantial number of the personnel (44.6 percent) indicated a positive attitude about this reform. Most people here believe that the key issue is not how the Institute should be reorganized, but how to improve the quality of management. They also believe that this reform will only have moderate encouraging effect.

Question 5: What is your view on organizational reform?

Reply	Will Improve Work Efficiency	Will Only Have Moderate Promotional Effect	No Real Change	Probably Make Things Worse	Do Not Understand	Other
Percent	13.4	31.2	24.8	7.6	19.1	3.9

The reply "No Real Change" was given because it was felt that changing the organization will not really solve any problem; the important point is to strengthen the management team. Only by promoting capable and business-minded technical managers to replace the incompetent ones can we really change the quality of the management team and the overall situation.

A certain number of replies (19.1 percent) were in the "Do Not Understand" category because the detailed organizational plan had not been announced to the public.

Question 6: What do you wish to gain most from this reform?

Reply	Eliminate Mediocrity Improve Efficiency & Produce High-Quality Results	Monetary Reward	Improve Quality of Management	Improve Research Support	Other
Percent	45.9	29.3	26.8	13.4	9.6

Question 7: What is your most urgent problem at the present time?

Reply	Promotion	Improved Housing	Higher Income	Better Job Security	Improved Research Conditions	Other
Percent	19.1	34.0	34.4	14.0	27.4	7.6

Most of the research personnel (45.9 percent) clearly understood the purpose of the reform. But a significant number (29.3 percent) indicated desire for improved wages and benefits; this fact cannot be ignored.

The majority of people (82.4 percent) are most concerned with problems related to improving the standard of living, with higher wages being the No 1 demand. The fact that such a demand was raised after a recent wage adjustment (some people received two consecutive promotions) reflects the persistent problem of inadequate wages and the disparity between wages and job titles. Another urgent problem is "Improved Housing." A typical example is the newly promoted research associate and City model laborer, Sheng Guanqun, who shares only 6 square meters of living space with his family of four; this is a problem that clearly needs to be resolved. To attract attention, some members purposely wrote their names on the "anonymous" survey forms with conspicuous markings.

In the category of "Improved Research Conditions," the urgent problems include: over-crowded laboratories, delays in procuring scientific equipment and manufacturing research parts, and shortage of young assistants for various research tasks.

For those who joined the research institute or entered college during the period of "cultural revolution," and for research trainees who already received their master's degrees, the most urgent issue is "Promotion." In fifth place is the issue of job security.

Question 8: Given the following opportunities, what would be your first choice?

Reply	Given a Responsible Position	Classified as Superior Worker	Study Abroad	Receive Major Science Award	Receive Degree (Master, PhD)	Time to Improve Health	Other
Percent	16.6	3.8	15.8	21.0	4.5	19.1	21.7

Question 9: What is your biggest complaint?

Reply	Wage Too Low	Poor Working Condition	Too Much Housework	Lack of Opportunities for Self Improvement	Misunderstood by Management	Too Much Job Resistance	Other
Percent	34.4	17.2	23.0	26.8	14.0	5.7	13.4

Most technical personnel hope to receive a major science award, or to study abroad, so they may advance in their career.

16.6 percent of the technical personnel hope to be given more responsibility by the organization. They also hope to be understood better by the management, and be assigned important tasks in accordance with their training, so they can fully develop their capabilities.

The No 2 complaint is "Lack of Opportunities for Self Improvement." In particular, the key personnel at the Institute are under so much pressure that they can only learn a few fragmented courses on their own during spare time. It is their sincere hope that various forms of education systems and more education opportunities be made available in order to keep their professional knowledge up to date. They hope that leaders of the Institute would "invest in intelligence," and recognize the equal importance of investment in intelligence and scientific achievements.

Question 10: What would be your choice with regard to different job assignment?

Reply	Leave the Institute	Remain With the Institute	Indifferent	Outside Supplemental Assignment	Other
Percent	5.7	34.4	38.2	9.6	12.1

Question 11: Where do you think the main problem lies in this Institute?

Reply	Leadership at the Institute	Administrative Departments	Branch Office Research Office	Task Group	Other
Percent	49.7	42.7	6.4	3.8	5.7

Those who wish to have outside supplemental assignment imply that they still want to remain with the Institute; these people generally have a technical specialty and believe they can receive offers from other organizations. Of course they are only a small minority.

In terms of problem areas within the Institute, the majority of opinions are centered around the "Leadership at the Institute" and the "Administrative Departments"; this reflects strong dissatisfaction among research personnel with the leadership and the administrative departments of this Institute. They hope that through this reform, the mode of operation and attitudes of the leadership and the administrative departments will change; much of the bureaucracy will be eliminated, the operational efficiency will be improved, the difficulties and troubles of the public will be heard, better research conditions and more education opportunities will be provided for the technical staff, in order to develop more talents and produce better results.

Question 12: What kind of wage and bonus reform do you prefer?

Reply	Fixed Wage With Floating Bonus	Part of the Wage and Bonus Both Floating	Job Related Subsidy	Keep Status Quo	Indifferent	Other
Percent	33.1	5.1	30.6	14.6	17.8	1.3

This survey and analysis revealed the following points:

1. Reform of scientific research organization is inevitable. But the situation at research organizations is rather complicated; there are many ideas and strong opinions about administrative policies. Each item of reform must be carefully planned and implemented according to the unique characteristics of the research organization.

2. The issues that are of most concern to technical personnel are the research environment, productivity, and ability to develop more talents. With regard to material rewards, they do not care about monetary awards, but favor a regular wage adjustment and promotion policy where income is based on contributions.

3. In terms of improving the quality of technical management, the key issue is that the leadership of the Institute (including the administrative departments) must comply with the objectives of the four modernizations, must raise the qualifications of the administrators, and make substantial changes in the intelligence and age requirements. Otherwise, there would be only superficial changes but no real reform.

Note: In questions 6, 7, 8, 9, 11 and 12, those responding sometimes marked two or more replies, thus resulting in more than 100 total percentage. In questions 1, 2, 3, 4, 5 and 10, some of the replies were not marked; in computing statistics they were included in the "other" category.

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SUGGESTIONS TO IMPROVE RESEARCH, CURRICULUM ON SCIENTIOLOGY PROPOSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 8, 1983 pp 13-14

[Article by Tian Fu [3944 1133]: "Enhance the Establishment of Science Disciplines and Raise the Level of Study on Scientiology"]

[Text] Recently, scientiology has been officially approved and listed in government documents as one of the disciplines in which degrees can be conferred. This is both an encouragement and a challenge for researchers in scientiology.

To strengthen the curriculum in scientiology and raise the standard of scientiology research, I am offering the following suggestions:

First, we should establish a number of institutions dedicated to the research and teaching of scientiology. In scientiology research, significant results have been achieved by devoted enthusiasts and by technical managers who combine their own work experience with research. But for the purpose of long term development and producing outstanding results, it is clearly not sufficient to rely on amateur enthusiasts; a dedicated research team must be established. The object of scientiology research is to conduct an overall study of science itself and of the organization and management of scientific activities and related policies. Therefore, it is quite essential to establish a well-structured research organization and to utilize such research tools as data bases and computers. In addition to existing research offices dealing with scientific policies, other organizations such as technical management offices, science coordination systems, higher institutions, and research institutes can also set up offices to do research on scientiology, technical management, and scientific policies. This is an important prerequisite for future curriculum development and for achieving a higher standard in scientiology research. At present, many universities are offering courses in "scientiology"; some have established specializations in technical management and engineering. Indeed, all qualified universities should establish teaching and research organizations in this field.

Second, we should actively support those comrades with special skills and capabilities to do research in scientiology, with the intention of producing

a team of PhD's in scientiology. We should create favorable conditions for researchers who have already achieved significant results, and for young scientists who have committed themselves to scientiology research; we should provide them with research funds and reduce their political activities so they devote more time to the study of scientiology. In the future, a number of young comrades and college graduates will participate in scientiology research; we should do our best to cultivate this new research force. At the present time, not only do we need a certain number of comrades devoted to theoretical research, which includes translation and research of scientiology literature; but we also need a larger number of researchers devoted to the study of many practical problems in China's scientific activities. It should be our goal to produce a team of highly qualified research talents who will rank among the leading international scientiologists and publish technical papers in international scientiology journals.

Third, scientiology researchers should participate in the study of China's long range development plan in order to make substantial contributions to China's management policies. No scientific discipline can be a pure academic study. The study of scientiology can only thrive if it is compatible with the society's needs, and is closely tied to the struggle of changing the society and the natural environment. Scientific and technical activities are having an increasingly greater impact on today's society, economy, politics, and education; on the other hand, the effectiveness of a nation's scientific activities is limited by the social, political, cultural, economic, or even psychological factors. It is no longer possible to keep scientific activities and technological research isolated from other aspects of the society. Currently, China is exploring and studying the target of national development for the year 2000 as a basis for establishing national policies and planning; scientiology scholars should actively take part in this study.

Fourth, we must insist on using Marxism as a guide in scientiology research; we must insist on applying scientific methods and developing scientific attitudes. Scientiology is a field where natural science and social science intersect; the study of scientiology requires a highly integrated and practical approach, but it also requires theoretical thinking. One cannot ignore the guidance provided by the philosophical ideas of Marxism, particularly dialectical materialism, in scientiology research. To study scientiology, we must emphasize both scientific attitude and scientific methodology. Some research topics require qualitative analysis as well as quantitative and model analyses to produce results which will be of practical value. For the purpose of making in-depth progress in scientiology research, it is healthy to have different opinions and different schools of thought. However, we must emphasize cooperation; cooperative effort is the key to successful development of a comprehensive curriculum in scientiology.

Fifth, research conferences should be held to make contributions in the development of intellectual resources in scientiology, and in the coordination of scientiology research with the training of technical personnel. The central government has initiated a program to re-train government officials in order to improve their management and leadership capability; however,

the training program is designed to provide not only general scientific knowledge but also new concepts and leadership skills to replace traditional methods. Only by acquiring knowledge in management science and leadership science which reflect modern trends of social development can we achieve modernization in management skills and become fully aware of the principles of Marxism. Scientiology research must devote more efforts and carry a heavier load in developing intellectuals and training government officials. This year, the education committee of the national scientiology and S & T policy research conference initiated a correspondence course for scientific and technical managers at four different locations. Approximately 12,000 officials in leadership and management positions enrolled in the course; through self-learning and supplemental lectures, they systematically acquired knowledge in management science. The course was obviously well received as many other provinces, cities, and regions have requested that we continue this effort. In the future, the national scientiology and S & T policy research conference is planning to join force with other associations and conferences to provide training for high-level officials and executives.

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STRUCTURAL ORGANIZATION OF RESEARCH INSTITUTES DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHI GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 7, 1983 pp 17-21

[Article by Liu Zefen [0491 3419 5358]: "Talking About the Structural Organization of Research Institutes: An Inquiry into Organizational Reform"]

[Excerpts] The structural organization of research institutes refers to the basic, support, and management units of which research institutes are composed (such as research offices, laboratories, library information offices, planning divisions, labor and wage divisions, experimental factories, etc.), along with the institutes' specialized chains of command and modes of communication. The forms of structural organization are determined primarily by institutes particular category and research mission.

In general, the structural organization of our nation's research institutes can be placed in one of two large categories: those formed by the Academy of Sciences and those organized by government departments. The organizational setup of research institutes of Academy of Sciences usually has two parts: a management structure (personnel and security, professional office, administrative office, and finance and accounting) and a professional structure (research offices, laboratories, computing stations, instrument centers and library information offices). These Academy of Sciences research institutes operate with a research director responsibility system under the leadership of a party committee. Thus they also have a party leadership system, in addition to such mass organizations as labor unions and the Communist Youth League. See Figure 5. Departmental research organizations are primarily engaged in applied research and developmental research. They have complex work procedures and handle a wide variety of research. The professional organizational system for such research institutes is divided according to discipline, mission, product or production process.

Principles and Requirements in Establishing Research Institute Structural Organization

Setting up an internal structure for a research institute is not something that comes spontaneously or can be determined subjectively but must instead be based on the demands of scientific development and careful and thorough planning and be centered on the mission of the institute. However, our actual

Figure 4

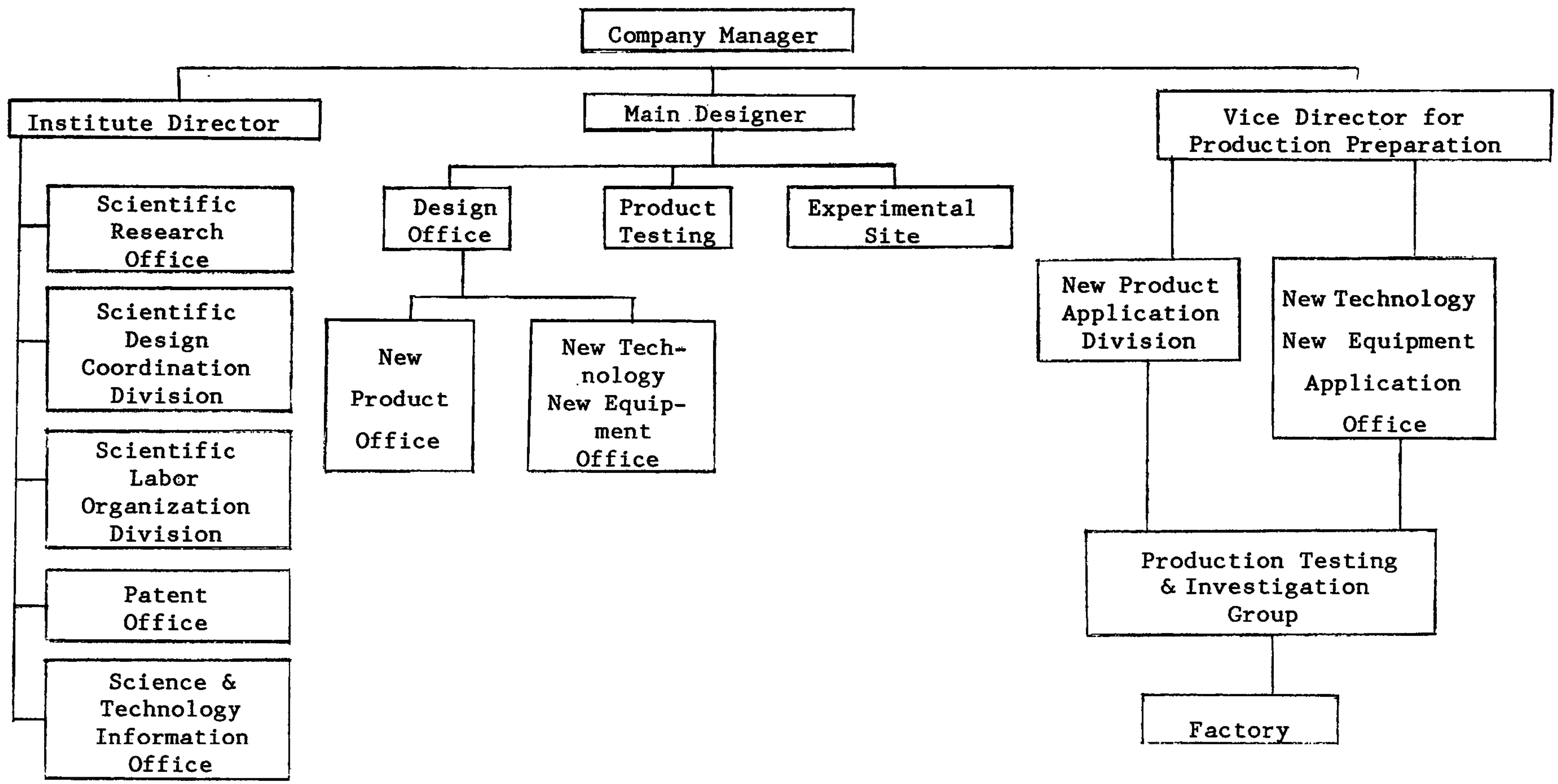
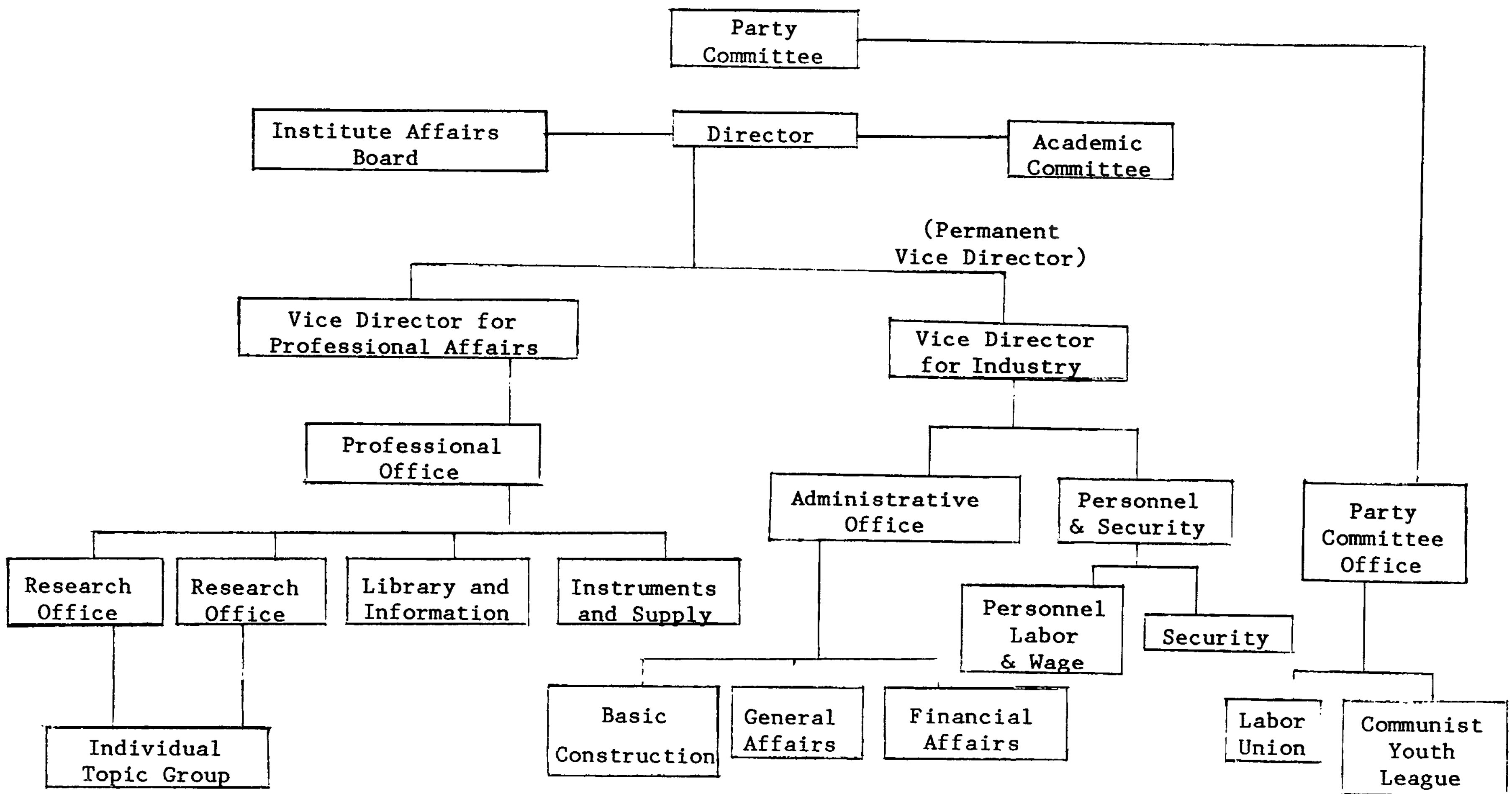

Company Manager
Institute Director
Main Designer
Vice Director for Production Preparation
Scientific Research Office
Scientific Design Coordination Division
Scientific Labor Organization Division
Patent Office
Science & Technology Information Office
Design Office
Product Testing
Experimental Site
New Product Office
New Tech-nology New Equip-ment Office
New Product Application Division
New Technology New Equipment Application Office
Production Testing & Investigation Group
Factory

Figure 5


Party Committee
Institute Affairs Board
Director
Academic Committee
(Permanent Vice Director)
Vice Director for Professional Affairs
Vice Director for Industry
Professional Office
Administrative Office
Personnel & Security
Party Committee Office
Research Office
Research Office
Library and Information
Instruments and Supply
Personnel Labor & Wage
Security
Individual Topic Group
Basic Construction
General Affairs
Financial Affairs
Labor Union
Communist Youth League

work is never like this. In setting up, dismantling or consolidation of agencies we either copy the structures of other research institutes, follow what is in vogue at the time or even proceed entirely from the needs of personnel assignment, which hardly constitutes making organization more rational or scientific. This kind of situation (even if isolated) must be changed immediately. For this reason, we must grasp the principles and requirements in establishing the structural organization of research institutes. Generally speaking, these principles and requirements are as follows.

1. Systems theory methods should be used to design structural organization. Selecting a structural organization is not the goal; rather, carrying out the mission facing the institute is primary. In this regard, we must first draw up a structural chart outlining the mission of the research institute, splitting up the overall goal into first- and second-rank goals, etc., and bring basic work and ancillary work together in a unified, stratified chart. Once there is a supple structure, the structural organization can reflect it responsively. This will ensure that the special features and levels of the structural organization ranking system will be clear, understandable and unlikely to cause confusion.

2. The structural setup should have a full complement of management procedures: forecasting, consultation, policy-making, implementation and examination.

3. Organs should be clear-cut, with as few levels as possible, to ensure that vertical channels of command and horizontal ones for cooperation work well. "Large and complete" and "small and complete" structural setups should be avoided, since the search for "completeness" inevitably leads to overstaffing and a lack of efficiency.

4. Responsibilities at the basic level of the organization should be clear. Rational division of labor and cooperation must be ensured in order to avoid reduplication of functions and to prevent one organization from assuming two or more different kinds of functions. The entire structural organization should be an organic whole which operates without congestion or gaps.

5. The structural setup should feature research departments and foster the strengthening of academic leadership.

6. We must ensure flexibility in the structural organization of research offices and stability in support and logistics departments.

7. The size of basic-level units should be set according to their workloads.

8. When goals and missions are changed, the organizational structure should be reorganized or rebuilt accordingly.

Questions To Be Noted in Setting Up Scientific Research Institute Organization in Our Country

1. The institute director responsibility system under the leadership of the party committee must be thoroughly effected, to ensure that the director can exercise his functions and powers within the organization. The party committee exercises its leadership primarily over principles and policies, and its work is primarily to take care of political and ideological education, establish party organization, adjust various sorts of relations and ensure that the work of scientific research is carried out smoothly. The institute director is in overall control of administrative and professional work of the entire institute. In order to ensure that the director can fully and effectively exercise his powers and functions, a permanent director's office should be established to aid the director in both professional and administrative management work. In this way, the director can be removed from trivial business and concentrate his endeavors on the important problems of the institute as a whole. Such an office, moreover, organizationally ensures the director's ability to exercise his powers and functions.

2. Establish and perfect institutes' academic committees. There is little difference between institute academic committees, for which elections are under preparations, and institute affairs conferences. The committee is but an academic evaluation structure that busily discusses academic position titles. This interpretation is one-sided. The academic committee should first and foremost be an advisory agency which can offer scientific, policy-making suggestions to the institute's leaders on such important questions as research direction and plans and academic exchange activities. At the same time, the committee can evaluate major scientific papers, research results and the academic levels and accomplishments of science and technology [S & T] personnel within the institute and offer opinions on achievement awards, appointments and promotions for such personnel. The committee should be comprised of people who love and are accomplished in their work and who have made contributions to S & T or achieved important research results. This is different from selecting leaders at various levels; and the membership should not be too large.

3. Strengthen S & T information and forecasting agencies. If scientific research institutes are to break new ground and select topics accurately, they must have reliable informational foundation and credible S & T forecasting. Since the growth of all new S & T arises from previous scientific knowledge, future developmental trends can be anticipated only through conscientious synthesization of existing scientific knowledge. This is a law that some research managers constantly overlook. Although some units have established informational structures, all information work conditions remain unsatisfactory and unable to play their true role. With regard to S & T forecasting, most research institutes still have no agenda. We must note the fact that, with the rapid development of S & T and S & T information, S & T personnel have found it increasingly difficult properly to coordinate research and information, though these personnel have always demonstrated their competence in such work. Personnel and agencies should be

established to specialize in S & T information. S & T consultation cannot be limited to normal library materials services or materials published by S & T personnel and managers. Instead, consultation should also include studies of recent developments and standards in S & T and S & T management both at home and abroad. Such studies should provide general reports on conditions, analyses and suggestions, so as to facilitate determination of research topics and programs. S & T forecasting directly serves S & T planning and so excellence in this area is closely related to informational work. For this reason, research institutes should establish specialized agencies for S & T information and forecasting.

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RESPONSIBILITY SYSTEM FOR SCIENTIFIC RESEARCH DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 7, 1983 pp 23-24

[Article by Cui Wanchang [1508 5502 7022] and Wu Shimin [0702 0013 2404] of the Science and Technology Department of the Ministry of Chemical Industry: "Several Problems to be Studied Regarding the Implementation of the Responsibility System in Scientific Research"]

[Text] Since the Third Plenary Session of the 11th CPC Central Committee, many types of economic responsibility systems have been implemented on the industrial and agricultural fronts with very good results. Those systems effected on the agricultural front, especially, have shown conspicuous, marked and encouraging results. Since 1982, under the spirit and guidance the leadership has shown in directing rapid reforms in all fields and on all fronts, many scientific research units have been positively deliberating and thinking about carrying out reforms. Some research units in a few areas and departments have experimentally implemented various types of scientific research responsibility systems in order to find the system best suited to the units' special needs. The scientific research contract responsibility system is one of the more commonly adopted forms.

Experimental results indicate that the scientific research contract responsibility system organically integrates the interests of the state, the unit and the individual and the responsibilities, authority and interests of research institutes, research offices, special topic groups and individuals. The system has been helpful in changing the outmoded ideas that research is "a soft job" and a "flexible job" and toward smashing the egalitarian situation of "eating out of the same big pot." The system has mobilized the initiative of research units, science and technology [S & T] workers and the broad mass of staff and workers; increased work efficiency; helped put S & T results quickly into production; and improved technological and economic results for society.

However, it must be noted that the special characteristics of research work differ from those of industrial and agricultural production. The various responsibility systems employed on the industrial and agricultural fronts should not be mechanically applied to research units. Many problems remain to be explored, studied and summarized.

The Relation Between State Planning and Units' Selection of Their Own Scientific Research Topics

In our socialist economic development, our nation has put into effect a policy based primarily upon state planning with supplementary market adjustments. As reflected in a unit's research tasks, it is incumbent on that unit first of all to ensure fulfillment of the research plans assigned by the various leading departments of the state. Under this initial premise, a unit can select and initiate additional research topics according to its own strengths and conditions and the demands of society and production upon S & T. Yet all research units must first guarantee that the research plans set forth by the state are fulfilled with regard to timeliness, quality, and quantity and ensure a full commitment of human resources, material resource and funds. At the present time, some units testing the scientific research contract responsibility system are engaged in a one-sided quest for economic profit for themselves and stress their own research topics while ignoring or even refusing to accept the research tasks assigned by the state. Of course, this "ignoring" and "nonacceptance" are not expressed as outright refusal of national tasks but rather by looking for all sorts of excuses and reasons, by evasions and by delays. Some units have tendered absurd terms to the departments assigning state plans. Some units have not given sufficient attention to or necessary guarantees of planning arrangements, personnel selection or research conditions. Conversely, these units have concentrated their personnel and material resources on the "immediate benefit" topics they themselves selected to increase their own income. As a result, though these units have provided new products, technologies, techniques and equipment to a few manufacturing and mining enterprises, increased their own profits and obtained more awards for their staff and workers, they have had an adverse effect on the fulfillment of the state's research plan. As everyone knows, the state's research planning is done in accordance with the overall development of the national economy and relates to the national mission in its entirety. If this mission is not fulfilled on time, there will inevitably be losses for the state and society in technology and economics, which losses may occasionally be huge. For this reason, no matter what type of contract responsibility system a research unit puts into effect, that system must first be in agreement with the state-assigned research task, whose completion must be guaranteed in terms of timeliness, quality and quantity. If this basic task is not successfully and effectively completed, no matter how good or how fruitful a unit's own research topic is, that topic cannot be held to be a fulfillment of the contracted state task.

The Relationship Between Social, Technological and Economic Results and the Economic Income of a Scientific Research Unit

Right now, some units trying out the research contract responsibility system have contract quotas which call for increased income and reduced expenditures. Some of these quotas take 1982 figures for actual income and expenditures as standard bases. Others set the average of the three years 1980-1982 as a base. Many units have ruled that if their income targets for the entire year are met they will set aside a specified amount of funds as bonuses for

all their personnel. These bonuses will vary proportionately to the amount by which the target was exceeded. The higher the surplus, the higher the bonuses to be awarded.

We feel that this method can play a role in increasing units' income, reducing government fiscal responsibilities, increasing the potential for expanding of research work and providing sources of welfare and bonuses for staff and workers. However, research units, after all, differ from village production brigades or urban mining and manufacturing enterprises. The mission of research is not to provide material products directly to society but to provide knowledge "products": new techniques, technologies, equipment and goods. By transferring the results of its research to production, the research unit impels and promotes the development of society's productive force and creates even greater social, technological and economic benefits, e.g., upgrading production technology standards, product renewal, reductions in the use of energy and raw materials, improvement in working conditions, etc. If fixed income deductions or incremental, supraquota income deductions are incorporated into research contracts and used to determine units' income and bonus awards, three deviations may result.

First, research units will be encouraged to pursue income for themselves and stress small projects with direct economic income while ignoring, dropping, or even going against their basic missions. From the standpoint of the individual unit, doing this may lead to a large or even multiple increase in income for the unit and its staff and workers; but this will correspondingly reduce or delay the research results (especially those key technical results urgently needed for national economic development) the unit should provide to society and to national economic construction. This cannot be anything but a huge loss to society as a whole.

Second, analysis indicates that the income of some scientific research units basically consists of two parts: income from the profit on small-scale production of research goods and the net profit on S & T results--compensated transfers, signed research contracts, technical services and consulting, etc. Of these two parts, small-scale research production accounts for approximately 60 to 80 percent. In order to exceed income targets, some units always concentrate a portion of their S & T personnel and facilities in production in order to increase profits. As a result, these units deviate from the correct path of their primary function--scientific research. For this reason, we feel that the two kinds of income should be strictly distinguished when scientific research contracts are implemented and that different rates should be adopted for deductions. As for income accruing from small-scale research production, taxes should be remitted to the state in accordance with policy regulations (truly new products may obtain tax moratoriums for a few years in accordance with regulations but ultimately should be transferred to factories for production to avoid monopoly of technology and production), and deduction rates from this income should be kept down. As for income from technology transfers, research contracts, technical services and consultation, etc., units should be permitted to raise deductions to provide for bonuses.

Third, a one-sided search for economic income can easily lead to neglect of research on basic theory, application foundations and technological development and affect key projects in S & T at all levels. This may create harmful consequences for scientific research and national economic construction.

In summary, when the scientific research contract responsibility system is implemented, unit bonus allotments should be fixed in accordance with how well units complete their research tasks (especially how well they fulfill those set forth in the state plan) and should not be based primarily on economic income levels.

The Guiding Ideology of the Scientific Research Contract Responsibility System Must Be Rectified

The implementation of the scientific research contract responsibility system comprises one part of the effort to reform research management. Errors are bound to appear and should not be difficult to overcome. However, the key is that guiding ideology must be correct. At present, leaders of some scientific research units put too much emphasis on keeping funds in the unit and seeing that staff and workers make more money and haggle with higher authorities over bonus rates. These leaders feel that only by emphasizing bonuses can they motivate their staff and workers and thus do not direct the attention of their units and workers toward improving research management or work efficiency or toward producing more results and talent. Rather, these leaders divert attention to haggling with the state over profits and bonuses. This is manifestly inappropriate. In fact, the broad mass of S & T personnel, staff and workers do not demand endless increases in bonuses but, rather, ardently seek to end egalitarianism in bonus allocation and "eating out of the same big pot." All levels of leadership should fully understand this point. If leadership does not change the situation wherein it does not matter whether things are done or not, how much is done or how well things are done, the initiative of the broad mass of staff and workers will never be mobilized, no matter how much bonuses are increased.

Moreover, in implementing a scientific research contract responsibility system, emphasis should be placed on "responsibility" and on improving work efficiency and research management. For this system to achieve proper results, all that is required is that research tasks be rationally divided in such a way that each part is fulfilled by research offices, special topic groups and individuals, that a responsibility system be established for each position and profession; and that strictly scientific evaluation systems and principles of rewarding diligence and penalizing laziness be implemented.

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PROJECT CONTRACT SYSTEM IMPROVES RESEARCH WORK

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 7, 1983 pp 25-26

[Article by Wu Xichun [0702 6932 4783] and Zhang Jingwen [1728 2529 2429], Chengdu Municipal Science Committee: "The Project Contract System Changes the Face of a Research Institute"]

[Text] A powerful wind of reform is blowing into scientific research agencies, whose work consequently is undergoing profound change. The Chengdu Institute of Electronics specializes in computer application development and employs 104 persons, 60 of whom are scientists and technicians. The institute has used economic methods to manage scientific research in the last few years and signed contracts with consumers in order to mobilize the initiative of all scientists, technicians, staff and workers. Over the past 4 years, the institute has completed research, trial production and dissemination of 29 new products, all of which have been used in production and daily life with marked results. Moreover, through contracts and small-scale trial production of the results of its research, the institute earned an economic income of 1.2 million yuan, five times the funding it received from higher levels for scientific research during the same period. Other than a small portion which has been used to improve living conditions of the institute's scientists, technicians, staff and workers, the bulk of this income has been reinvested in research to accelerate the institute's development.

In the past year, the institute has also implemented "project contracts" and "project accounting" as the core of its research-project contract economic-responsibility system. The institute has carried out bold reforms in manpower utilization, incentives and management, further mobilizing the initiative of science and technology [S & T] personnel, staff and workers. These reforms consist primarily of the following elements. First, projects are clearly determined. Projects proposed by consumer units are discussed by the institute's academic committee and decided by the responsible director. Then a contract is signed with the consumer unit, and the project is listed as a new task for scientific research and trial production. Such projects are also assigned by higher authorities. Additionally, individuals undertake projects on behalf of consumer units. Following approval, such projects are also listed as the institute's new tasks for research and trial production, and contracts are signed between the institute and the individuals

concerned. The second element consists of voluntary registration and free organization of project groups. Formal establishment of such groups is subject to agreement by the research office and approval from the institute, and group directors are to be democratically elected. S & T personnel may undertake projects across groups or offices, and individuals may assume more than one task. Third, project groups and the institute's professional affairs division sign contracts which include the following important elements: participating personnel, the substance of the research scheme, technical requirements, priority conditions, completion time, economic revenue, penalties and incentives, etc. Fourth is the implementation of contracts and project accounting. Once a contract is signed, the project group makes up an implementation plan assigning tasks to individuals and clarifying those tasks, work assignments, responsibilities and benefits. During the contract period, the professional affairs division and the research office get together on a regular basis to make adjustments and solve any problems which come up. If, during that period, technical forces or levels are deemed inadequate, additional personnel from inside or outside the institute, may be hired, and the hiring unit or individual shall bear responsibility for that personnel's remuneration. "Independent project accounting" is during the contract period and includes all expenses (including: those for materials, component parts, raw and processed materials, manufacturing, external coordination, travel and management) incurred by the project group from the time the contract takes effect until acceptance and delivery. The fifth element consists of evaluation, acceptance and delivery and rewards and penalties. Once the project is completed, the project group submits an acceptance request, and a group composed of the institute leadership, the professional affairs division, the research office, the financial affairs office and other relevant personnel then evaluates and accepts the project in accordance with the contract. Upon fulfillment of their contracts, all project groups may set aside 3 to 8 percent of their net incomes as bonuses depending on the workload, degree of difficulty, time involved, and the new income. At the same time, the groups should appropriately consider proportionately smaller bonus allotments for projects with more income and larger allotments for projects with smaller earnings. For projects with earnings exceeding contract specifications, 5 to 10 percent of the excess will go as a bonus to the group. The group distributes bonuses to project participants along principles of more reward for more work. Groups failing to fulfill their contracts are penalized through elimination or reduction of bonuses, depending on the degree of unfulfillment, and by requiring compensation through wage deductions over time for 0.1 to 1 percent of the losses caused by that failure. The total amount of bonuses for the entire institute is restricted to no more than 10 percent of net earnings, but there is no limit on individual bonuses, which are distributed as specified in contracts. The monthly 7 yuan per person bonus has been eliminated.

In addition, the institute has implemented a management responsibility system, which uses the contract point method; sets personal responsibilities and evaluation standards according to division, and office and work type; and evaluates each manager at regular intervals. The value of the "points" is set at the end of each year and based on the completion status of the tasks

and earnings of the entire institute. Generally, managers are evaluated and graded by the responsible members of their divisions or offices, the responsible members are evaluated and graded by the institute director and the latter is evaluated and graded by the institutes' employee representatives committee or business committee.

The project contract system has already achieved initial results.

The contract system joins together responsibilities, authority and benefits; mobilized the initiative of S & T personnel and further exploits the technical potential within the institute. At the end of last year, we made arrangements for only eight research and trial-production projects for this year yet still felt that our technical forces were insufficient and that the projects could not be completed. But after implementing contracts, were able to arrange and implement 13 projects, an increase of 40 percent over the original plan. And we estimate that, without adding any new personnel, this year's research and trial-production workload will be double that of last year. The reason for this is that, once the contract system was implemented, project groups were freely formed, S & T personnel could move between groups and offices and participate in several projects, and groups could undertake two projects. Consequently, we were able to complete more projects and achieve more results without adding personnel.

Implementation of the contract system has also strengthened people's sense of responsibility toward their work and accelerated the process and shortened the cycle of scientific research and trial production. This is due to the facts that work assignments, tasks, responsibilities and economic benefits have been clearly established for each project group member and that those members who produce quality goods receive handsome awards and those whose goods are shoddy or wasteful are penalized.

This reform has also strengthened S & T workers' sense of economics. The utilization rate for component parts has been raised from 70 to over 85 percent; overstocking and expenses have been reduced; the previous tendencies of ignoring costs and of extravagance in research work have been more effectively checked; and unity, cooperation and spiritual civilization have been spurred. The smooth completion of contracts requires close coordination and cooperation among project group members and between the groups and management divisions and offices. Every group member has to pay attention to maintaining these relations. Otherwise, no one will want to form a group with him. So it is that some comrades have said: "Not only does the project contract system spur material civilization, but spiritual civilization as well."

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IMPROVING EFFICIENCY OF SCIENTIFIC RESEARCH DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 5, 10 May 83 pp 38-39

[Article by Wang Peitang [3769 1014 2768], Dalian Chemistry and Physics Institute, Chinese Academy of Sciences: "Several Factors in Improving the Efficiency of Scientific Research"]

[Text] According to analyses, the efficiency of China's scientific research work today is only 50 to 60 percent for the superior units and around 30 percent for the inferior ones. Improving the efficiency of scientific research is an urgent issue awaiting solution. If China's scientific capacity is raised 10 percent, it will be equivalent to expanding the scientific and technological contingent by several hundred thousand men and increasing the investment by several hundred million yuan.

Many factors are involved in improving efficiency. This writer feels that there are mainly the following five aspects: accurate selection of research projects; continuity of research work; rational intellectual composition; scientific implementation; enthusiasm of personnel. This article will analyze three aspects by using as illustration the "new technology of electrochemical production of chlorates," an applied research project conducted by the eletrochemical engineering group of the Dalian Chemistry and Physics Institute.

I. Continuity of Research Work

The history of scientific and technological development clearly tells us that science and technology differ from material products. While the latter have a limited service life, the former produce a lasting social effect,because they can be understood, disseminated and preserved. With the development of society, new science and technology must replace the old, but the new can only be developed on the basis of the old. Therefore, in terms of the research project group, studying and mastering our predecessors' scientic knowledge (including our own scientific reserve), referring to their experimental techniques (including our own technological accumulations) and utilizing their experimental conditions and methods (including those created and mastered by ourselves) are extremely important. The electrochemical engineering group gave attention to the following points.

1. Valuing Scientific Reserve. The research on the new technology of electrochemical production of chlorates was launched on the basis of the research on fuel cells in the previous 8 years. The two major achievements in fuel cell research won state awards. In the 8 years of research, the personnel concerned made reference to several dozen documents and summarized them into volumes, wrote several dozen reports and published papers, uncovered a number of new concepts and new laws, and won the high opinion of those in the same field in the country. Though the tasks and requirements of the new project differed from those of the projects completed in the past, they belonged in the same field of study in essence, and their experimental principles were basically identical, inseparable from electro-catalytic reaction and from the transmission of momentum, heat and matter. Therefore, the voluminous scientific reserve of the past became the important basis for the new project. One may say that the new project was not building from the ground up, but adding another story to a building.

2. Utilizing Technological Accumulations. The research on electrochemical production of chlorates involved many techniques such as preparation of electrodes, chemical industrial designing, equipment installation, reaction operation and analytical survey. If we had to start from scratch to master these techniques, it would require much time and energy. But with the technological accumulations of the past, it became much easier. Both past and present researches, for instance, sought to find a long-lasting, highly active and inexpensive electrode. Though the compositions of the electrode catalysts were not all the same and the techniques of preparation also differed, the whole set of electrode preparation techniques already mastered provided extremely favorable conditions for the project.

3. Developing the Effect of Existing Material Conditions. The start of a new project often requires much time to prepare the conditions, but if attention is given to developing the effect of existing material conditions when selecting a subject, much time can be saved. The electrochemical engineering group gave full attention to this point. The several kinds of crucial materials selected for use in the new experiment had been trial manufactured by outside units by special requests; therefore, it was very convenient to use them again.

II. Rational Intellectual Composition

The intellectual composition is a multidimensional dynamic synthesis. To organize an ideal research project group, we must, on the basis of its nature and needs, start from the compositional concept, giving consideration to the intellectual capacity, knowledge and quality of the members as well as their specializations and ages. Except a very small portion of projects involving basic theories, almost no modern research project can be handled by just one kind of specialists, and a high degree of meticulous combination is required. For different projects, the intellectual compositions of the research groups cannot follow the same mold. We

should organize them on the basis of the essence and demands of concrete projects and according to specific rational proportions and, in line with the developmental conditions of the projects, readjust the composition from to time, seek a dynamic equilibrium, and keep the projects in the optimum developmental state from beginning to end. The practice of the electrochemical engineering group tells us that, to become a high efficiency research collective, the question is indeed not to make the personnel as large and as advanced as possible, but to form the best combination of the various specializations and talents among the members. Such combination will emit a gigantic new force and accelerate the progress of the project.

1. Strong Academic Leadership. The electrochemical engineering group is a research project group in engineering and chemistry in the Dalian Chemistry and Physics Institute. The academic leader is an old scientist with rich experiences and a keen observational power. He played a decisive role on many key issues. The project leader is a quick thinking mid-level research personnel in his prime possessing knowledge in many fields. He was able to seek the guidance of the old scientist while exploring the collective wisdom of the group. With his own experimental theories and design models in the midst of a strong academic atmosphere, he propelled the project forward in range and depth.

2. A Collective of Superior Combination. Different research tasks require different research, engineering and technological personnel. The project on the new technology of electrochemical production involved three or four fields of study and more than 10 techniques. In terms of academic background, qualifications and level, the 17 members (4 others were engaged in another project) of the electrochemical engineering group, as a whole, were not very high, but the personnel composition was fairly commensurate with the need of the task. Each taking his post and each contributing his ability, the scientific and technological personnel scattered on the various energy levels formed an organic and coordinated academic collective and effectively promoted the development of the project.

3. Dynamic Equilibrium. The practice of the electrochemical engineering group again demonstrated that the personnel requirements vary with the different developmental phases of the same project. General speaking, less people are needed during the phase of investigation and study and exploration, more are needed when tackling key problems, and a gradual reduction may become desirable after the problems have been surmounted. In the recent 3 years, the personnel of the electrochemical engineering group were changed and readjusted several times. While the changes and readjustments were not all for the purpose of rationalizing the composition, objectively the personnel flow itself produced a regulating and balancing effect, so that talents were put to full use, thereby benefiting both the development of the intelligence and wisdom of the personnel and the progress of the research tasks.

III. Scientific Implementation

Unlike production, scientific research always requires continuous exploration and innovation. Therefore, the determination of projects, the formulation of programs, the intellectual composition of personnel, the osmosis between different fields, academic exchanges, and organization of technological strengths to tackle key problems cannot be managed according to simple administrative methods. We must act according to the developmental laws of science and technology themselves in our organization and management work. In the research on the new technology of electrochemical production of chlorates in the past 3 years, the research group was relatively successful in organizing implementation in the following aspects.

1. Academic Leadership. Three years ago, the fuel cell project involving more than 100 persons and lasting 8 years was concluded. Whither the electrochemical engineering group which took part in the project? The institute leader reminded them that when choosing a new project, they must value the existing foundation. But where would the new project come from? At this juncture, the academic leader in engineering chemistry proposed the preliminary concept of research on the new technology of electrochemical production in conjunction with the energy conservation of the electrolysis industry. Relying on collective wisdom, the project leader arranged fundamental experiments of a preliminary nature while organizing everyone to conduct social surveys and analyze documents and data. After repeated demonstrations, the project was finally determined. In the process, the academic and project leaders and the collective directly involved in the project produced a guiding effect. Meanwhile, the administrative leadership, management branch and party organization also rendered much support. The institute leader organized experts to hold intensive discussions and evaluations before the research was finally decided as a key project.

2. Respect for Creative Spirit. As no domestic or foreign written information was available at the beginning of the research on the new technology of electrochemical production, there was no comparison or precedent in regard to the accuracy of the experimental plan, the feasibility of the technological line and the rationality of the experimental steps and means. All these had to depend on the scientific and technological personnel for correct determination by means of their existing knowledge and their practice. The administrative leadership and management branch respected the creative spirit of the personnel and refrained from criticizing them when they made changes in the program or readjusted the rate of progress. At the start, the proposed research project was the new technology on electrochemical production of chlorine and Alkali. But after a time of practice, it was discovered that a crucial material for the experiments was not available inside in the country at the time; therefore, it was difficult to proceed. Under this situation, they revised the original program and plan and decided to undertake research on the electrochemical production of chlorates. As proved by practice, the revised program was more realistic and easier to achieve.

3. Correct Research Program and Technological Line. According to the structural viewpoint, the categories of sciences include basic, technological, and applied sciences, the three parts. Regardless of which field, all includes "theory" and "technology." In terms of technological and applied sciences, the theoretical part is often overlooked. Some people even feel that applied research is like "frying vegetables" and requires no detailed research program and technological line, and that it is alright to take one step at a time. However, for this reason, some applied research projects, after expending large volumes of manpower and material, showed very little progress and had to be abandoned after several years of effort. At the start of the electrochemical production project, the research group utilized the experiences and accumulations of their work on fuel cells in past years, made overall analyses according to information found in documented material and data from preliminary experiments, and proposed their own assumptions, concepts and design models on the research on electrochemical production. With the progress of the research work and heightened understanding, they judged the time and sized up the situation, made many revisions of the experimental program, and kept the development of their work always in the right direction.

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RESEARCH PROCEDURE, MANAGEMENT OF APPLIED SCIENCE DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 6, 20 Nov 82 pp 33-36

[Article by Zhao Zhide [6392 1807 1795] of Shanghai Industrial University: "Research Procedure and Management of Applied Science"]

[Text] Scientific research according to research procedure is an important aspect of its management. It has direct effects in avoiding duplicate labor, speeding up the progress of scientific research, improving the quality of the results, and obtaining greater economic results.

Scientific research as a system is generally divided into basic research, applied research and pioneering research.

This article will attempt to give a tentative description of the method to compile and practice the research procedure of applied science and the problems involved.

Unlike that of factory production, the process of scientific research is subject to the effects of the difficulty of the assigned task, the changes encountered in the progress, and other restricting conditions, and therefore cannot be based on a set formula. Generally, the entire process of the research in a scientific topic consists of four stages, 12 steps, 24 substeps and the corresponding examination and approval, planning, coordination, checking, evaluation and management procedures. (See Table 1)

Table 1.

Stage: The setting of tasks	
Link: Topic selection	
Research procedure:	Research substeps:
1. Choice of subject	(1) Source of task (2) Information checked and studied (3) Final choice of subject
2. Introduction	(4) Subject analyzed (5) Introduction confirmed

[Table continued on following page]

3. Exposition	(6) Division of work organized (7) Assignment to lower levels or contracting

Management procedure: Organizational plans verified

Technical documents, data: Investigative report, planned task documents or contracts

Stage: Technical preparation

Link: Research plan design

Research steps:	Research substeps:
4. Planning design	(8) Continued study (9) Task document (10) Monographic study (11) Program of action
5. Technical confirmation	(12) Technical confirmation (13) Practical plan
6. Technical design	(14) Design examination

Management procedure: Confirmation

Technical documents, data: Report on confirmation of program of action, practical plan, work plan, technical task documents, technical instruction manuals, calculation data, technical documents, design blueprints.

Stage: Experimentation and implementation of research

Link: Experiment and investigate

Research steps:	Research substeps:
7. Preparation	(15) Design for experiments (16) Preparation of materials
8. Experimentation	(17) Readjustment of conditions (18) Trials and tests (19) Inspections and testing
9. Formulation of conclusions	(20) Formulation of conclusions

Management procedure: Inspection and coordination

Technical documents, data: Record of expenses on procurement, record of tests, report on experiments (including reports on experimental production or use), report on cost analysis, report or thesis on technical research.

Stage: Evaluation and dissemination of research results

Link: Appraisal and dissemination

Research steps:	Research substeps:
10. Evaluation	(21) Preparation (22) Evaluation
11. Action on results	(23) Action on results
12. Dissemination of results	(24) Dissemination and application

Management procedure: Comment and forwarding for approval

Technical documents, data: Appraisal
Certificate of appraisal
Table of results

First Stage: Setting Tasks, Topic Selection

Whether the subject chosen is accurate, correct, opportune and advantageous has a direct bearing on the progress and final result of the entire research project. Especially when science and technology are developing rapidly, the posing of problems, in a certain sense, is usually more significant than the solution of problems in certain aspects of scientific research. We should devote more efforts to topic selection in light of our national conditions and for the purpose of promoting economic development. A wrong choice may cause duplication and waste, unnecessary labor, and loss of opportunities. Therefore, while ascertaining and arranging a subject for scientific research, we must be positive and yet cautious, conduct meticulous analyses, subject it to strict scrutiny, and decide on the choice without missing the opportunity. This is particularly necessary for large projects which call for large investment and long construction periods and have a strong influence on other projects. Since their success or failure will produce a strong repercussion, we must be extremely careful in their handling. We cannot afford to be careless or to carry out the exposition without much thought.

The stage of topic selection includes three steps.

Step 1: Choice of Subject

(1) Source of Task

The history of development in industry, science and technology has clearly shown that the subject of research in applied sciences is intended to increase the social productive forces and to improve the modes of living. Along with the development of modern science, technology and economy, the sources of tasks for scientific research have become very numerous and are making new and higher demands. Generally, these two aspects should be considered: first, direct solution of the scientific and technological problems in production and in the development of science and technology; and second, a breakthrough in science and technology themselves so as to create new orientations continually for the development of production and technology and to spur on a technical revolution and technical transformation. The former means the use of tasks to lead the subjects, while the latter means the use of subjects to promote the tasks. The channels and methods used in both are different, but they have the common objective of serving economic development.

We can set the tasks on the basis of, or by getting some lead from, different points of view:

Task--long-range planning, annual plans, forecast analysis, delegation of authority, and personal initiative;

Data--monopoly, documents, theses, research reports, and other information data from books, pictures and so forth;

Departments--governments, departments, trades, scientific research, production, marketing, consumer and management organs;

Activities--inspections, symposiums, exchanges, examinations, interviews and enquiries.

The choice is generally made through three different channels: assignment from above, delegation of authority through contracts, and choice on personal initiative. The significance of choice on personal initiative cannot be ignored, since the scientific and technical personnel are proficient in their profession and enjoy greater freedom of action in making their choice based on their own knowledge, experiences and interests. They usually have many good, novel and highly promising ideas.

(2) Information Checked and Studied

The process of choosing a subject is one of checking on the monographic scientific and technical information. In order to make a good choice, the scientific and technical personnel must attach great importance to the checking and studying of information so that, through various channels, they can make full use of the available information by purposefully collecting the research results and experiences of other people as well as the various static and dynamic types of technical and economic information by scanning, searching, tracing, accumulating, sieving, analyzing and evaluating the information, and by trying to understand the history, present status and trends, as well as the problems of and changes in the subject under research. By this means, they will clearly understand what they are doing and apply themselves in the correct direction. Science and technology are developing very rapidly in the present world, and fresh research results are continuing to emerge. Efficient checking and studying of information in making foreign things serve China will provide a shortcut to the correct choice of subject.

(3) Final Choice of Subject

On the basis of information checking and studying and a comprehensive analysis, the next step is the final choice of subject. On the one hand, this means clarifying, assimilating, and dissecting foreign technical data and conducting a vertical analysis of the technical and economic information (such as technical plans, theories, properties and so forth). On the other hand, it means a horizontal analysis of the information (such as the degree of necessity, the key technology, the practical methods, the existing conditions, and so forth) in light of our national conditions, noting the new signs, new directions and new channels, and adopting the good ones for ourselves. Then the outline of exposition will be discussed before the final choice is decided on.

Step 2: Exposition

This is the process of monographic forecast, analysis and synthesis of the chosen subject by the scientific and technical personnel, who will weigh the pros and cons in light of the necessity of the exposition, the possibility

of accomplishment, and the benefits to be derived from the popularization. Generally, an analytical study is conducted in three different aspects.

(1) Progressiveness. An advantageous starting point for the substance of research and the index of properties should be selected. In other words, there should be an advanced characteristic that is more effective, more novel and even more rational than the current technology. This progressiveness should be demonstrated in scientific and technical values and in economic competitiveness.

(2) Feasibility. This means forecasting the feasibility of exploitation and application starting with an analysis of various conditions and factors. (See Table 2)

Table 2.

	Factors	Targets
Technical value	Progressiveness	Determination of nature: program of action, special features, methods, measures, quality form, index, parameter, structure
	Suitability	Effects of technical proliferation, coordination with related technology, technical superiority, extent of practical use.
Economic value	Market	Competitors, capacity, scope, extent of demand, prospects of sales.
	Benefits	Investment, cost, profit, price, tax, recovery period.
	Resources	Raw materials, accessories and spareparts, energy exploitation, consumption, utilization.
	Time	Degree of urgency, period of validity
	Reliability	Reliability of properties, safety, convenience, effectiveness.
	Exploitation	Direction of exploitation, amount and level of technical resources, conditions of developing facilities and equipment for production.
	Environmental protection	Pollution and damage, utilization and control, prevention and treatment
Social value	Effects of employment rate, occupation, pattern and distribution of production, relationships between departments and localities, administrative system, modes of production	
Others	Conformity with changes in the political situation, the policy of economic development, and the technical policy (material policy, importation policy and the policy of standardization, serialization and general utilization).	

(3) Applicability. To ascertain the feasibility of the target, we must make full use of the current industrial and technical foundation and economic conditions. The necessary conditions for conducting scientific research are: Scientific and technical personnel, sources of information, research funds, time, equipment for experiments, supportive materials, means

of processing, organization, management and other measures. We should do only what is within our capability. If we over-commit ourselves and if our resources are short of what we would wish, it will be difficult for the project to be completed.

Based on the result of forecast and analysis, the expository report can be worked out, and its contents should include the purpose and significance of the research, conditions at home and abroad, the substance of research, the indices of technical properties, the key techniques, the practical technical line, the expected result, the current foundation and conditions, the time limit for completion, the approximate progress, budget allocations, personnel organization and the relations of cooperation.

The scientific and technical personnel will forward the expository report to their department in charge of examination and approval, while the department in charge will in turn organize the experts to discuss, comment on, and appraise the project in light of its scope, the difficulty involved, the quality and other related problems.

Step 3: Exposition

After the appraisal, the planned task documents will be forwarded to the leadership for verification and approval. Later, the departments in charge, in collaboration with the other departments concerned, will appoint the responsible persons for the project, form the task group, include the task in the annual plans, allocate funds, and issue the notice of assignment or sign the contract. They may also report to the higher authorities and notify the finance, supply, personnel, logistic and other departments in charge. The stage of task setting and the process of choice of subject end here.

The task of choosing a subject is a complex one. In the course of implementation, there are many uncertain elements and risks. There are many factors to be considered, and some of them are mutually contradictory and restrictive. We cannot count on total satisfaction, and that is why we have to pay attention to the focal points without neglecting the others. We must make every effort to make our breakthrough at the focal points and thereby give an impetus to the others. Furthermore, the following points should be noted:

(1) Bringing into play the strong points to highlight the specialties. In choosing a subject, we must bring into full play the unit's specialties, conditions, potential, its technical personnel's expertise, the utilization of external factors (such as regional advantages and relations of cooperation) and use its merits to make up for its shortcomings. We must avoid any duplication and prevent the project from becoming commonplace.

(2) Combining long-range and short-range projects with priority for the latter. We must first attend to the tasks required to meet urgent needs, but suitable arrangement should also be made for the tasks which are highly

significant for the orientation so that we can build up a technical reserve for the future. Attention should be paid to the exploration of certain spheres of science of a continuous nature without, however, losing sight of those spheres (such as the theoretical study of basic technology and applied theories) which have not been taken seriously or have not received any attention previously. We must carefully avoid the practice of trying to be in vogue and rushing in for what is considered popular.

(3) Proceeding in an orderly way and developing by stages. Tasks may be heavy or light, difficult or easy, long or short in duration, involving one or more subjects, belonging to localities or departments, and having different scopes, depths, levels, areas of involvement, and substance of research. We must proceed in an orderly way instead of making any hasty advance in the quest for quick success.

(4) Relationship between projects and tasks. Generally, projects refer to the categories within a profession, while tasks mean the problems requiring solution. The titles (also called headings) should be concise and clear, and should actually include the main substance, such as the subject under study, its special qualities and sphere of activities, and the assigned duties. It should be suitable for the use of technical terms. However, it must not be bombastic and exaggerating.

(5) Relationship between centering around the topic and digression. In the course of research, we should proceed by centering our efforts around the assigned duties instead of rambling on away from it. If the situation is changed or if some problems occur, some corresponding changes can be made. However, we must follow the routine of scientific research management reported and approved. Furthermore, the main direction of attack should be clearly defined and the scope of research should not be too sweeping.

Stage II: Technical Preparation and Design for Program of Action

Program of action means the technical channel, method and plan for meeting some expected demands. It comprehensively embodies the idea, vision and objective of the scientific and technical personnel engaged in the task, and is in the form of technical documents for the purpose of guidance. Therefore, working out the optimal program of action, which is both technically feasible and economically beneficial, is also a very important link in the process of research.

There are three steps in working out the program of action.

Step 4: Design for Program of Action

The design for a practical program of action includes the following concrete jobs:

(1) Compiling the technical task document.

The task must be clearly defined, and the goal must be specific with a quantitative numerical data index. The technical task document is the basis of technical design and a document of an investigative nature which must undergo the procedures of examination and approval.

(2) Monographic Study

In order that the drafted program can be more correct and feasible, we must conduct a monographic analysis of the focal points (the key problems affecting the overall situation), the difficulties (the problems which cannot be easily solved) and the dubious points (the problems which cannot be easily grasped) of the task. If necessary, imitative experiments of a theoretical nature can be conducted.

(3) Design for the Program of Action

A concrete design for the program of action begins only after full preparation. As demanded by the assigned duty and by different conditions and feasibilities, the task group should develop technical democracy and creatively employ the scientific and technical personnel's know-how, technical skill and experiences to work out different programs in dealing with the key problems and the essence of each problem for selection. These programs should be forwarded to the relevant departments for appraisal, comments and examination before the policy decision is made.

Contents of the design for program: The purpose, application, main aspects of research and experiments, technical and economic indices, the basis of designs, the theory of work (for the comparison of different programs), the overall system, the main components, the items of experiments, the procedures of experiments, the way of completion and the time required, analysis of the feasibility of accomplishment and development, and description of other items and reference materials.

In designing the program, we should also work out the plans of implementation, and the substance of the plans should include the plans of progress, the line-up of personnel and division of work, the plans for the processing of special instruments and equipment, major items of instruments, materials and accessories, items of external cooperation, expenditure estimates and assurance of technical and material supports.

In designing the program, we should use the fairly mature technical results already available instead of relying on our own exploration of everything from scratch and thus repeating what others have already done. Attention must be concentrated on the creative key components.

A correct program is usually obtained after repeated comparisons with other programs until the best one is found. In handling certain important tasks or those tasks which are subject to sudden changes, some alternative program should be available to avoid serious incidents or losses.

Step 5: Technical Appraisal

To implement the designed technical program, to complete it on time with quality guaranteed, and to avoid any rash action and waste of efforts in the course of implementation, technical appraisals must be organized. The technical experts of the same trade and the personnel of the interested departments connected with the leadership, management, production and consumption activities, and particularly those representatives who hold different opinions should be invited to fully air their views so that their constructive ideas can be pooled. Through technical appraisal, examination and comments, the ideas for improvement expressed in the conclusions in the feasibility study or in the deliberations can be forwarded to the relevant departments to be used as the basis of their policy decisions.

The organization and implementation of technical appraisal as a research routine are in line with the principle of scientific management which must be observed in working out any program. This is also an effective scientific method.

Technical appraisal must be carried out in accordance with scientific and economic laws. In light of objective conditions, we must truly understand the technical, economic and social aspects of the situation, verify the conditions, compare the different programs, forecast the results and carry out a feasibility analysis. We must also ascertain whether we can solve problems through technical evaluation, clarify the problems through academic evaluation, and determine the results through economic evaluation before finally offering our views for policy decision.

In order that the technical appraisal will be fruitful, we must make full preparations in working out the plans for appraisal, and adopt effective methods to set up the necessary appraisal routines. Furthermore, we must take the following measures in carrying out the appraisal.

(1) We must take a realistic scientific approach and strictly guard against the practice of being flashy and without substance, or doing things merely as a formality.

(2) We must set strict demands for the appraisal to be logical and systematic.

(3) There should be some leeway, since all conditions are relative. Should there be any problem that cannot be solved immediately, we must reserve it for monographic research instead of drawing hasty and wrong conclusions.

(4) We must oppose any conclusion reached by a small number of persons simply with a bang of the hammer but without full discussion.

(5) We must carefully handle the relationship between technical appraisal and the keeping of technical secrets.

Step 6: Technical Design

When technical design has begun after appraisal and approval, it is necessary to compile the entire set of technical documents and draw the whole set of blueprints including the design, theories, calculations, instructions, the design for the main body and spareparts, the system diagram, theoretical diagram, technical design, design for self-made equipment, plans for practical tests, detailed procedure for inspection techniques, detailed tables showing materials required and external cooperations.

This routine is very technical and must be carefully handled, since every line, numerical data and component must conform to reality and the principle of achieving greater, faster, better and more economic results. The completed design should be examined by the person responsible for the task or by the leadership in charge of the work.

FURTHER ON RESEARCH PROCEDURE, MANAGEMENT OF APPLIED SCIENCE

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[Article by Zhao Zhide [6392 1807 1795], Shanghai Industrial University: "Research Procedure and Management of Applied Science"]

[Text] After the stages of topic selection and research plan design, the research in applied science then enters the implementation stage.

Stage III: Experimentation and implementation of research

"Everything must go through the experimentation stage" is especially true for topics in applied science research. Technical plans and documents are merely research proposals; they must go through the step of experimentation so that problems may be revealed and technical requirements may be evaluated. The original proposition can then be verified or modified experimentally and reliable technical data necessary for the development application can be accumulated. Scientific research is based on facts and must withstand the test of practice. Experimental research consists of three steps: preparation, experimentation and formulation of conclusions:

Step 7: Preparation

Preparation includes making the experimental design specific, establishing a responsibility system, purchasing equipment and material, and processing and test-production of material.

(1) Design of an experimental outline involves: clearly defining the goal and significance of the experiment and specifying the project requirements, steps to be taken, technical conditions, facilities and time needed, apparatus required and data to be recorded.

(2) Determining the type of experiment. Due to the limits on investment, time and other material conditions, experiments usually develop gradually. (a) In terms of experimental scale, there are laboratory-scale (exploratory) experiments, semi-production scale industrial (intermediate) experiments, and production tests. (b) In terms of what is being tested, there are real-object tests, model tests, and theoretical verifications. (c) In terms of user requests, there are characterization tests, general tests, field tests, reliability and system tests and routine tests.

(3) Experimental method. The established special prescriptions and methods must be followed. New test methods must be certified before being accepted.

(4) Experimental setup. The apparatus selected for the experiment should be reliable and stable, special apparatus should be fabricated and the development of major pieces of equipment should be made a special project. Apparatus should be checked and calibrated before the experiment to make sure it is stable and accurate and meets all experimental requirements.

(5) Calibration standards. International and national standards should be used in calibrating and checking the technical conditions of the equipment.

(6) Recording method and statistical system. The design should be compatible with the characteristics of the field of research, the method should be convenient for graphing and tabulation, and the data should be classified and analyzed. A working system should be established to record the raw data and to transmit, process, analyze and store the experimental results.

Step 8: Experimentation

This step is highly technical and requires a longer time. It consists of a number of activities such as tuning, operating, observing, sampling, calibrating, recording, analyzing, checking and processing the data. The experimenter mustbe conscientious, careful and skilled. Records should be organized clearly and represent the data accurately, experimental results should be accurate, reliable and consistent, and the data should be reproducible. The accumulated numerical data and analyses should be entered into reports after each phase of the experiment. In any case, experimentation is a crucial step of research and must be conducted objectively, carefully, and seriously, without any sloppiness or exaggeration. Unhealthy tendencies such as speculation and falsification should be strictly avoided.

Experimentation is usually conducted in three areas:

(1) Specifications tests. Before the specifications tests the system should be properly adjusted and the material, equipment, and procedures should meet the technical requirements of the experiment.

Specifications tests are usually conducted in the laboratory according to the specific requirements of the research topics and special standards; performance tests of new materials, tests of the principles of a new technology and simulation tests are all specifications tests. Reports are submitted after the tests.

(2) Trials. Trials are performed on real objects to evaluate and verify their performance and thereby determine whether the project results are mature and reliable.

Trials include production readiness tests, on-site tests, intermediate or semi-production scale tests, and production-scale tests. Trial reports are submitted based on the test results.

(3) Testing evaluation. Test results should be evaluated in terms of the standards or specifications applying to inspections or measurements in order to judge whether the tests have been passed and what quality indicators have been achieved. This procedure is an indispensable step in the testing process to insure the quality of the products.

Step 9: Formulation of Conclusions

This is the last step of the experimental research. Experimentation and investigation are interconnected. Experimental results must be interpreted by theoretical analysis. Any experimentally verified result has its limits of validity and a certain probability of error and must be verified theoretically in a general analysis, i.e., the process of formulating the project findings. This formulation of findings may reveal the nature of the object of study or identify patterns, thus providing a guide for practical applications. The final forms in which the findings are presented include research papers, reports, technical drawings and the like. Specifically, the findings should include the following aspects:

(1) Data processing and investigation.

Large amounts of raw data should be qualitatively evaluated and quantitatively analyzed, using numerical statistics and graphical and verbal description. The task of data processing should include inference, calculation, comparison, analysis and organization, and should provide reliable, representative, complete numerical data.

(2) Analysis of technical and economic effectiveness.

If scientific research is to produce economical results, an analysis of technical and economic effectiveness must be made. Cost and efficiency must be analyzed and evaluated scientifically. Attention should be given to the relationship between qualitative and quantitative, between direct and indirect, and between intellectual and practical results. Analysis reports are written based on the analysis results.

(3) Writing of research reports and academic papers.

Reports and papers should include a description of the origin of the research topic, the goals and significance of the study, the historical background and current status, the content of the investigation and the problems to be solved, experimental results, efficiency analysis and problems that remain to be investigated.

(4) Organization of the technical documents and preparation for technical evaluation.

Stage IV Evaluation and Dissemination of Research Results

Step 10: Evaluation

The evaluation of research results includes preparation, application, preliminary examination, evaluation, registration, reporting and filing. The main steps are preparation and evaluation.

(1) Preparation. First the research group submits its "Results Evaluation Application" and a preliminary examination is carried out in the same department or unit to determine whether the result qualified for evaluation. The examination covers (a) completeness, i.e. whether the problems are solved; (b) extent of breakthrough, i.e. academic or technical creativeness and quality of improvement or reverse engineering; (c) integrity, i.e. completeness and reliability of hardware (or samples) and software (or documentation); and (d) maturity, i.e. analysis and prediction of production and application feasibility.

After the preliminary evaluation, the unit then determines to what level should the results be submitted for verification (ward, bureau, municipal, ministerial or national level). The "Results Evaluation Application" is then forwarded level by level and evaluation meetings are held after the replies are handed down.

(2) Evaluation

Evaluations should be conducted conscientiously and practically. Consideration should be given to technological democracy and high standard, measurements should be verified, documentation examined, and the technology evaluated. After sufficient questioning and discussion, fair, objective, and practical evaluation opinions are then formulated which succinctly describe the problem, solution and suggestions.

Efforts should continue after the evaluation meeting to solve the problems that still remain and to continue to improve the results. A good evaluation should combine a critique with efforts to disseminate the results, that is, improvements should be made by considering both technology and economics, and both research and production.

Step 11: Action on Results

This includes issuing opinions, reporting to the superior and handing out awards.

Step 12: Dissemination of Results

The goal and the final step of research application is to publicize and apply the results. Application of research results not only raises science and technology to a new level but, more importantly, it also realizes technical and economic utility value. Science and technology must adhere to the policy of serving economic construction. Speeding up the pace of the application is an important task of science and technology. The stimulus which science and

technology give to economic development is realized mainly through the application of research results a direct productive capabilities. By putting the results to active use, one obtains both real economic benefits and a snow-balling effect in the process of technology transfer. When scientific and technological results are not promptly promoted and applied, not only do we miss the timely opportunity to use them, but economic losses also result. Promoting and applying the results is therefore an expression of a concern for technical and economic performance.

The following issues should be considered in the dissemination and application of research results.

(1) Conditions for dissemination and application

(a) Quality is the prerequisite for promotion and application. Quality here refers to the sophistication of the technology, reliability, economic benefits, and competitiveness.

(b) Scope of application: this includes objective conditions, local suitability, applicability and range of application. The first application is important because it has some effect on later applications.

(c) The unit that promotes the product and the unit that uses it should cooperate and help each other. Technology transfer should be done with compensation and the work and responsibility should be shared. The unit disseminating the new product should take the initiative in considering the user's interests and should serve the user, while the user should actively accommodate and support the new product. In the meantime, the interests of the state, the unit, and the individual should all be taken into consideration.

(d) Make sure the user unit is capable of applying the technology effectively. Considerations to be taken into account are technical manpower, ability to accept and invest in the new product, availability and completeness of facility, components, material and energy, channels of supply, purchase, and sales, organizational regulation, favorable pricing and reasonable taxation.

(2) Methods of Disseminating and Applying New Products

To publicize new products and educate the users, one may choose from a number of approaches including information and academic exchange, journal articles, product display, or setting up technical service centers. Promotion can also be carried out by a combination of different modes such as research cooperation, customer solicitation, direct contact, agency contracts, research and production consortia, or inclusion in regional or departmental promotion projects. Promotional operation includes providing complete technical data and samples, inspection and emulation, on-site demonstrations and training workshops.

When production begins, efforts should be made to improve the product and to deal with any new situation or problem that may arise.

(3) Measures That Promote the Application of Products

The dissemination of products is constrained by a number of factors, and appropriate and effective measures should be taken to facilitate it.

(a) Improving the economic and research management system and the corresponding policy system. Examples are compensated transfer of results, pricing according to quality, expanded autonomy, establishing the responsibility system, and promoting the contract system. The interests of the state, the unit, and the individual should all be taken into consideration and the dissemination of research results should be made an evaluation criterion for units and individuals. In terms of research management, both topic selection and dissemination of results should be stressed.

(b) Major results should be disseminated systematically and methodically. Channels of supply, purchase and sales should be properly coordinated to maximize the benefits of dissemination.

(c) Promote cooperation between research units and production units. The collaboration may take place in a number of forms that benefit both parties. Laboratory research may be combined with production tests, software technology (technical proposals and experimental methods) may be combined with hardware technology (developing prototypes and process equipment), and cooperation and division of labor may be instituted, with both parties sharing the results and benefiting from the combination. The cooperative activity must be carried through to the lowest level in order to save time, reduce interference and obtain fast results.

(d) Provide technical service to support dissemination of research results.

(e) Protect domestic products, avoid aimlessly importing foreign technology. Components that cannot be developed right away may be selectively imported as a transitional measure to develop domestic technology and production.

In conclusion, applied science research is a complex procedure that depends upon a number of factors. In practice, the tasks, time, conditions, and methods should be unified and research procedures should be established based on the organizational system of the research unit, the type of research topics, and the degree of complexity, and variations in the progress of the research.

9411
CSO: 4008/216

PROBLEMS IN COMBINING SCIENTIFIC RESEARCH AND PRODUCTION

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 12, 10 Dec 83 p 1

[Article by Luo Renchang [5012 3387 2490], Guangxi Institute of Light Industry]

[Text] Scientific research and production are closely related, they promote each other, and they should not be separated. The key technical problems confronting production should be the subject of scientific research. Only by applying scientific achievements in production can we transfer it into a direct productive force and promote the development of production. The development of production will give rise to technological breakthroughs, which will inevitably give rise to new scientific demands, pressing scientific research to advance further. The close integration of scientific research and production depends on sound solutions to the following problems:

1. A Clear Direction in Topic Selection

The guiding principle for topic selection in scientific research is whether the research serves production. The concrete method for topic selection is to orient activities around a central idea and engage in seven services. The central idea is to improve economic results. The services are: to improve product quality, improve equipment, improve the people's livelihood, increase product variety, conserve energy, lower production cost and readjust the national economy. If the research results of scientific projects do not achieve the goal of improving economic results, it certainly will not be widely used by departments in charge of production. If no one applies scientific achievements, they are of no benefit to national economic development. Only those topics that achieve at least one of the seven services can expect to be widely adopted for use, thus being transformed immediately into a direct productive force and play a role in advancing production development.

2. The Setting up of Intermediate Experiment Workshops in Research Institutes

For scientific research to be oriented toward and serve production, an important link is to conduct intermediate or industrial experiments based on the foundation of small experiments. After intermediate or industrial experiments, research results can then be applied to production. The selection of the site for an intermediate or industrial experiment should be based on economy. If we conduct the experiment in a plant, it would be wasteful if the equipment were not used afterward. If we set the experiment in a research institute, the equipment can be used to provide data during application in production. The equipment can also be used for other research projects. To set up intermediate workshops in

research institutes, not only saves research investment but can reap the following advantages also: 1) can confirm the reliability from small experiments without delay; 2) can obtain more reliable technical and economic data to provide a basis for application during production; 3) will avoid problems affecting production in intermediate testing; 4) can provide more certainty for technology transfer of the results of scientific research.

3. Establish Close Contact Between Research Institutes and Plants

This is the key to whether or not research results can be transformed into a direct productive force. The result from intermediate experiments provides data for production application; however, this is not to be compared to operation. The major differences between intermediate experiments and production are: 1) the scale is different; generally the scale of production is greater than the scale of intermediate testing; 2) personnel are different; the intermediate testing is led by researchers who demand strict, precise and accurate data and experiments. After it is put into operation, workers at first are not familiar with the procedure and need proper training; 3) the operations and technology are different; technological parameters cannot be magnified but need to be explored and stabilized during production. Because of the above differences, researchers should go to the plant to help transmit the technology to the workers, and discover and solve problems during production. This will enable research results to stand on solid ground and develop beneficial results during popularization.

4. Researchers Who Are Experts, Flexible and Adaptable

A major problem during the process of combining scientific research and production is the disparity between the knowledge and the tasks given to scientific researchers. Technical problems which evolve during production activities are often complicated and encompass many aspects. The characteristics of scientific reseachers are: specialized training, narrow knowledge and weak adaptability. If researchers have expertise they can assume initiative in production, speed up the research progress, improve work efficiency and research results.

12453
CSO: 4008/135

REFORM ORGANIZATION SYSTEM TO DEVELOP SCIENTIST CREATIVITY

Shijiazhuang HEBEI RIBAO in Chinese 8 Aug 83 p 4

[Text] On 11 July the provincial government issued "The Notice Concerning the Reform of Industrial Enterprises' and Scientific Research Units' System of Managing Science and Technology and the Implementation of the Responsibility System in Science and Technology."

The notice points out that the implementation of the responsibility system in science and technology is a major reform of the system of managing S&T and that it is an important measure for the protection and encouragement of creative labor by S&T personnel. All levels of government must consider reform of the system of managing S&T and establishment of a sound responsibility system in S&T to be matters of importance that deserve conscientious emphasis in the areas of economic system reform and enterprise reorganization. In reforming the system of managing S&T and establishing a sound responsibility system in S&T, we must give full expression to S&T labor's creativity, probing nature and other characteristics. We should not copy the form of the economic responsibility system. It is necessary to sum up experiences everywhere on the basis of S&T personnel's various tasks and their needs for the expansion of production.

The notice provides several forms of the responsibility system in S&T from which industrial enterprises, specialized scientific research organizations and institutions of higher learning can choose. It stipulates that given the prerequisite of a complete system of personal responsibility, S&T personnel in industrial enterprises and scientific research units can obtain their units' consent to carry on their S&T tasks abroad. The notice requires that implementation of the responsibility system in S&T organically link S&T technical personnel's responsibilities, rights and profits. It must be emphasized that responsibilities come first. Ideological and political work must be reinforced so that S&T personnel will work conscientiously and responsibly. At the same time, we must link S&T personnel's remuneration or bonuses to the quality of their work and the size of their technical and economic results, in order to reward diligence and punish sloth. For this reason, every industrial enterprise and scientific research unit must set up a sound and authoritative organization for assessing technical proficiency. In every form of the responsibility system in S&T, all such units and enterprises must make definite the meaning of that assessment, the methods

of rewards and penalties, the sources of bonuses and the policy of the distribution of remuneration. To strengthen an enterprise's S&T work and to raise the standard of the management of S&T, each industrial enterprise and scientific research unit must establish a sound system of management of S&T. Large and medium enterprises must have general engineers who bear supreme responsibility for their firms' S&T work. Technical management departments, which resemble whole factories in that they embrace qualified enterprises and workshops, can have master engineers who are responsible for all S&T work in the workshops and technical offices. Scientific research units must implement the director responsibility system under party committee leadership. Their directors must be chosen by the S&T personnel to be responsible for the entire unit's professional work. Heads of technical offices may be recommended by the masses and confirmed by their units' directors. The notice also stipulates that the authorized number of an enterprise's S&T personnel should be distinct from that of administrative personnel. When an enterprise increases the number of the former according to its needs, it can ignore the limit on the total number of cadres.

The notice finally says that reform of the system of managing S&T and implementation of the responsibility system in S&T are necessities arising from objective circumstances. All levels of government and responsible departments must launch pilot projects conscientiously, probe bravely and improve constantly. They must execute this reform well and with the utmost fervor, fully mobilize S&T personnel's enthusiasm and creativity, and genuinely rely on S&T progress to improve economic results.

12465
CSO: 4008/218

SCIENCE AS A SOCIAL PRODUCTIVE FORCE DISCUSSED

Beijing RENMIN RIBAO in Chinese 25 May 83 p 5

[Article by Xue Jing [5641 4842]: "Science Is a Social Productive Force in General"]

[Text] Strengthen Scientific Research and Popularization of Science

Scientific achievements never drop out of the sky but are summed up from arduous labor by people through research, experimentation and application. Therefore, in order to truly give play to the role of science in developing the socialist economy, we must adopt concrete measures and strengthen scientific research and the popularization of science.

In order to strengthen scientific research work, we must first strengthen the leadership of science, incorporating scientific development into the strategic plans of state economy and social development, formulate correct scientific and technical policies and determine the orientation of scientific and technical development and research topics based on the needs of the national economy and social development. A scientific research project that is significant to national economic growth often touches on numerous aspects, involves a great deal of work, has a high degree of difficulty and is relatively more pressed for time under the demand for results.

Therefore, the best way is to organize strength from every quarter to tackle the problem. Second, we must comprehensively implement the policy toward intellectuals, be concerned about their political progress, arrangement for work and vocational studies, solve the difficulties in their living and guarantee that they will highly concentrate their energy to engage in arduous scientific research work. Third, we must build a sound scientific research organization and system. We must build a complete research organization for the study of all laws in socialist economic development which must be brought to light and which are economic, social and concern people's mental activities. We must also guarantee the corresponding stability of these organizations so that they will not be dissolved as soon as they are set up. Fourth, we must do our best in the popularization and transfer of scientific and technological achievements so that the productive forces of the formulation of knowledge will truly transform into direct productive forces. This requires us to formulate plans for adopting the achievements of

scientific research and formulate policies to encourage the adoption of new scientific and technological achievements and develop new products. Moreover, through legislative forms, we must safeguard the popularization and transfer of China's own scientific research achievements.

In order to develop science speedily, besides strengthening scientific research we must strengthen the popularization of science so that the scientific and technical level of the broad masses of laborers continue to rise. Only in this way can we increase their ability to apply the new achievements of scientific research and create new ones on this basis. The history of scientific development has clearly shown that the popularization of science and the rise in scientific standards are a dialectical unity. After the birth of a new scientific achievement, only through popularization can it create new and even more material wealth for the society and can we further raise the standards so that science and technology will grow without a halt.

In order to strengthen the popularization of science, we must first strengthen education and training with science and technology as the substance and use the achievements from scientific research to substantiate teaching materials and the substance of teaching. Popularization and rise in standards of science and technology cannot be separated from the popularization and rise in standards of education. For example, the application of electronic computers in great modernized production is broadening and the role it plays in the development of production is increasing. If we do not popularize and raise the standards of electronic computer education and if we do not arm the minds of people with electronic science, we will not be able to produce electronic computers or apply and popularize them. Therefore, in order to extensively utilize science and technology in production and reality, we must do so through educating and training laborers to manufacture, control and apply them. Second, we must popularly build organization for the popularization of science and technology, and form a dissemination network for science and technology such as building various levels of associations for the dissemination of science and technology, scientific and technical exchange stations and dissemination associations, publishing popular literature and using a variety of forms to organize dissemination forums. Third, we should build integrated bodies for scientific research and production. An integrated body for scientific research and production is an organic combination of science, technology, production and education. It is an economic organization and management form that promotes physical changes in technicians and workers cooperate closely and directly combine the development of new products, new techniques and new technology with technical consultation, technical training and the production and sales of products so that the orientation of scientific research is clear and so that production units will enthusiastically utilize new achievements in scientific research.

Modernization of Scientific Research

The modernization of science and technology is not only a modernization goal China must realize but is also a key to the modernization of industry, agriculture and defense. Therefore, in order to use modern science and technology

to arm all departments of the entire national economy, we must pay particular attention to the modernization of scientific research. The modernization of scientific research, in natural science for instance, is to study and master today's advanced scientific and technological achievements, make major inventions in some major scientific and technological realms, master the latest theories in natural science and have significant original ideas in some major scientific theoretical research. At present, topics for use in scientific research are numerous and we need to invest even more human and material resources to strengthen research in these areas. Not only must we understand the world but also transform it. We must find effective ways and adopt suitable actions to reach the goals of building socialism on the basis of our existing understanding of objective scientific facts and objective laws. Of course, we cannot underestimate research in basic science. Although sometimes the initial results of research in basic science may not play much of a role at the time, it will play an enormous role when the productive forces develops to a certain stage. This has been proven repeatedly by history. In order to realize the modernization of scientific result, we must also have the most advanced equipment for scientific experiments, modern scientific installations and a large experimental base.

In order to realize the modernization of scientific research, we must thoroughly investigate and study the state of scientific development in the world and China and make a practical and feasible research analysis of China's natural resources, human resources and other resources before determining the main source of assault in our scientific result, the training programs of our scientific and technical personnel, setting up a system for the evaluation and promotion of scientists and technicians, and strengthening international cooperation and exchange in scientific research. At the same time we must exert ourselves to realize modernization of experimental means, information and library work. In terms of social scientific research, we should be able to make Marxist analysis of practical problems in the development of contemporary human society. Particularly with China's economic construction, we must sum up objective economic laws that suit reality and use them to guide the people's actions. In the past 30 years we have suffered considerable losses because not enough attention was given to economic science and management science. Since the Third Plenary Session of the 11th Party Central Committee we have a much better understanding of these problems than before. We have carried out research and discussion of many important problems in economic science, changed the former state in which many subjects were ignored other than political economy and certain departmental economic subjects, and we have initially established certain disciplines that have originality.

The study of Marxism plays the most prominent role in scientific research and the popularization of science. We must systematically study Marxism as well as the three sources and three components of Marxism. Moreover, we must explain practical problems on a higher plane in terms of Marxist theory.

9586
CSO: 4008/121

SCIENCE ACADEMY TRANSFERS RESEARCH TO TIANJIN

OW160837 Beijing XINHUA in English 0815 GMT 16 Mar 84

[Text] Tianjin, 16 Mar (XINHUA)--An agreement has been signed between the Chinese Academy of Sciences and the Tianjin municipal people's government on long-term cooperation to supply new research results to Tianjin industries.

The academy submitted 58 projects, results of recent research, of which over 20 were considered by the port city as applicable. Twelve of the academy's institutes then held a number of workshops with Tianjin industrial bureaus, companies and enterprises. Fourteen contracts have been initialed and 37 statements of intent signed and another 96 are under consideration.

Both parties agreed to cooperate in six fields: computer use and development of software, biological fermentation and enzymatic engineering, new material technology including organic, non-organic and magnetic materials, chemical products such as flavorings, additives and chemicals for the tannery industry, energy-saving technology and environmental and ecological science.

According to the agreement the academy will give Tianjin access to new research results and deal with technical problems that occur in Tianjin industries. The Tianjin municipal government will organize application of research results and pay for the transfer of technology.

The two parties will meet annually to draft new plans and examine the previous year's implementation and problems.

CSO: 4010/64

PROFESSOR OUTLINES TASKS OF SCIENCE ACADEMY

OW230817 Beijing XINHUA in English 1030 GMT 22 Feb 84

[Text] Beijing, 22 Feb (XINHUA)--The Chinese Academy of Sciences this year will make greater efforts to tackle major research projects and help industry and agriculture gain quicker access to its research results, academy secretary-general Professor Gu Yijian said here today.

Gu told more than 350 scientists and administrators now attending the academy's working meeting that the academic body would:

--speed up research on major scientific projects, including technical problems relating to the development of Shanxi Province as an energy and heavy industrial base, biotechnology, oil extraction technology, new materials and computer and software technology;

--give industry and agriculture speedier access to research results;

--accelerate the construction of an electronpositron collider and a synchronous radiation accelerator;

--continue (?to) reform research fund management and institute a contract system;

--continue to restructure its research institutions; and

--apply computers to science management.

In 1983, the academy completed 1,700 projects, nearly a quarter of which have since been applied to production. It also won 11 awards for inventions.

At the meeting, Professor Lu Jiaxi, the academy president, spoke of its long-term research plans (1986-2000) and Professor Yan Dongsheng, its vice-president, gave a report on research guidelines during the Seventh Five-Year Plan period (1986-1990).

CSO: 4010/64

SCIENCE ACADEMY OFFICIAL GIVES RESEARCH GUIDELINES

OW071422 Beijing XINHUA in English 1317 GMT 7 Jan 84

[Text] Beijing, 7 Jan (XINHUA)--Scientists of the Chinese Academy of Sciences will make systematic research that is needed to aid China's key economic projects and offer scientific guidance for the development of production technology, academy vice-president Professor Yan Dongsheng said here today.

Speaking at the fifth session of the scientific council of the academy, he said the academy will intensify its program in applied research, take an active part in development studies and continue to pay attention to basic research.

Special attention will be given to such basic research projects with potential influence on the long-term development of science, technology and the national economy. Efforts will also be made to collaborate with all research institutions on the application of their findings, he added.

Professor Yan said China's industrial technology would have to be upgraded if it is to meet the goal of quadrupling industrial and agricultural output value by the end of the century. New technology would have to be developed to promote a major change in the country's industrial structure, he predicted.

Professor Yan said the academy's goals by the end of the century were:

--To tackle key scientific and technical problems in agriculture, energy, resources, environmental protection and feasibility studies for major construction projects, while strengthening research work for producing advanced equipment needed in the country's economic construction;

--To integrate basic research with technical science and catch up with the advanced world levels in fields including information science and technology, biological engineering, lasers, nuclear technology, computers and marine engineering. Breakthroughs are expected in some areas to pave the way for the pioneering of new industries and help upgrade existing plants;

--To attain advanced world levels of the time in some fields of basic research with broad prospects for practical application, in which China has a qualified research staff;

--To establish scientific data banks, information consultancy systems and forecast systems to provide data for the nation's economic policy makers;

--To train a contingent of scientists versed in advanced experimental technology and build a number of world-class laboratories.

Professor Yan proposed eight major fields of research for the academy's 1986-2000 program.

The eight fields are: agricultural science and technology; resources and environmental science; energy science and technology; materials and material science; computer science and technology; engineering sciences; life science and biological engineering; and physical sciences.

CSO: 4010/39

CAS PRESIDENT LU JIAXI OUTLINES REFORM MEASURES

OW060454 Beijing XINHUA in English 0138 GMT 6 Jan 84

[Text] Beijing, 6 Jan (XINHUA)--The Chinese Academy of Sciences will open its institutes to guest researchers in 1984, academy president Professor Lu Jiaxi said in a work report.

Speaking yesterday at a conference attended by more than 300 academicians, the professor said researchers from China's ministries and universities will be invited to use the academy's facilities in their research.

At the same time, he added, researchers from the academy's institutes will go to enterprises to offer guidance or research aid, and teach at universities and colleges.

The move will provide greater mobility for scientists and give industry quicker access to new research findings, he said.

Scientists assigned to institutes rarely moved to other institutions. As a result, the staff of some institutes was becoming increasingly aged, he noted.

Professor Lu said, the academy will establish a number of large-scale laboratories as national centers in fields including computer, software, biological engineering and material science.

The academy will also expand its science fund and continue its experiment on a contract system, under which groups of researchers will apply for grants before they begin their projects. Priority in appropriations will be given to research with foreseeable practical results.

It will try to modernize its information collecting, data processing, library and publishing systems, he added.

CSO: 4010/39

SCIENCE ACADEMY ANNOUNCES RESEARCH PROGRESS

OW041220 Beijing XINHUA in English 1150 GMT 4 Jan 84

[Text] Beijing, 4 Jan (XINHUA)--The Chinese Academy of Science is now concentrating on 29 key research projects, including 15 of the 38 major national problems to be solved before 1985, according to the academy today.

Eight of the projects are related to agriculture, including research on comprehensive development and exploitation of the north-China and northeast-China plains, the academy said. Seven involve energy, including key technical problems in constructing a national base for energy and the chemical industry in Shanxi Province and solving the energy shortage in the rural areas.

The others include four on developing new materials such as special alloys, high-molecular compounds, and inorganic structural materials, and seven on new technologies such as computers, large-scale integrated circuits, bio-technology, superconducters, laser, remote sensing and radiation.

Considerable progress has been made in some of these projects. Most are important to the development of the national economy and production technologies, according to the academy.

A laboratory of the Dalian Institute of Chemical Physics under the academy has developed a nitrogen-hydrogen separator for recovering hydrogen from the waste gas of synthetic ammonia production. Mass production of the separator is expected within two to three years. By using this separator, production output of a synthetic ammonia tower will be increased by 4 to 5 percent. This means the country's present output of synthetic ammonia may increase by over 600,000 tons a year.

A new catalyst, one of the academy's key projects, has been worked out by scientists of the Lanzhou Institute of Chemical Physics. A process that uses the catalyst to oxidize and dehydrogenate butene into butadien will help China's six major synthetic rubber plants reduce costs by 30 percent and increase production by 35 to 70 percent. The economic results may involve well over hundreds of millions of yuan across the country.

In 1981 and 1982 alone, the academy noted, it completed 3,704 research projects, 65 of which won national awards for natural science research results. In addition, the academy won 59 national awards for inventions since 1978.

CSO: 4010/39

CAS TO INCREASE POSTGRADUATE ENROLLMENT IN 1984

OW041214 Beijing XINHUA in English 1144 GMT 4 Jan 84

[Text] Beijing, 4 Jan (XINHUA)--The Chinese Academy of Sciences [CAS] this year will enroll 1,500 postgraduates for masters of science degrees and 200 for doctorates, according to academy sources here today.

The academy reintroduced the graduate program in 1978. Between 1981 and 1983, the academy enrolled nearly 3,600 graduate students for masters of science degrees and 309 for doctorates. During the period, 12 have been awarded doctorates and 1,125 given the master's degrees.

The academy said, some of the postgraduates have achieved quite good research results while studying.

The academy has sent more than 2,800 scholars and postgraduates overseas on research or study projects since September, 1978. About 1,400 of them have returned to work in its different research institutes.

The academy is trying its best to create favorable conditions for young scientists to promote their research ability. It is to institute an advanced study system among its research staff so as to keep their knowledge abreast with the advancement of science.

CSO: 4010/39

CAS SCIENCE FUNDS FINANCES MORE RESEARCH

OW010808 Beijing XINHUA in English 0706 GMT 1 Jan 84

[Text] Beijing, 1 Jan (XINHUA)--The science fund committee of the Chinese Academy of Sciences [CAS] financed 949 research projects across the country and in 22 central government departments during 1983.

Endowed with a grant of 41.13 million yuan (about 21 million U.S. dollars), the projects were selected from 1,700 applications the committee received. More than 7,500 experts and specialists took part in appraising the applications, the committee said.

Of the projects, 86.6 percent involved applied research on technical problems in the national economy, while about 11 percent had to do with basic scientific research.

Energy-saving, environmental protection, new technologies and agriculture were some of the areas covered.

A committee spokesman said the science fund was aimed at helping tap the potential of scientific personnel, especially those in universities and colleges where nearly half the financed projects were carried out.

The fund supported basic research in both the natural and applied sciences to aid economic construction. A number of projects of major scientific value were expected to show results within three to five years, the spokesman added.

Established in January 1982, the science fund committee financed 504 research projects with a grant of 28.3 million yuan in that year.

CSO: 4010/39

NEW PARTY CONSTITUTION SAYS MEMBERS MUST STUDY SCIENCE

Chengdu SICHUAN RIBAO in Chinese 23 May 83 p 3

[Article by Jiang Xianzhi [5592 0341 3112]: "Communist Party Members Must Study Science--Some Realizations from Studying the New Party Constitution"]

[Text] This matter of stipulating the study of "science" in item 1 of the duties of party members in the new party constitution is newly added by the 12th Party Congress, and no previous party constitutions contained it. This reflects higher requirements proposed by the new party constitution for party members.

Possibly some comrades will say that their education is poor and they cannot study science. Or they will ask if it is not all right for them to do a thorough job of their work and not study science. Some old comrades will even say that they have been in the party for decades, and ask if they did not conquer China for the revolution just the same without studying science. Comrades, you are mistaken! During the years of the revolutionary struggle, our study of class struggle and warfare was the study of the social science of Marxism. Now the emphasis of our party's work has shifted to socialist construction. This requires us even more to learn to struggle with and transform nature, and to create better living conditions for mankind. Studying natural science during the period of economic construction is as important as learning warfare during the war years. If we do not study natural science, we will be defeated in the struggle to transform and to exact better living conditions from nature.

Realization of the party program requires that party members study science. The party constitution clearly stipulates that, "In order for the CPC to realize communism's maximum program, all CPC members must give their whole lives to this struggle." Communism is the most idealistic and best social system of mankind's societies, and to have a high degree of development in the production of material goods, it is necessary to carry out the principle of "from each according to his ability, to each according to his needs." How can there be a high degree of development in the production of material goods? It is necessary to depend on the advancement and development of science and technology, and if there is not a high degree of development in the cause of science, and we only depend on our present backward production methods, then to talk of a high degree of development in the production

of material goods is only idle theorizing. Therefore, for a Communist Party member who has given his whole life struggling for the cause of communism, studying science is essential for our struggle toward the great goal of communism.

To complete the party's general task, it is necessary for party members to study science. The party constitution stipulates that, "The general task of the CPC at the present stage is to unite the people of all nationalities in working hard and self-reliantly to achieve, step by step, the modernization of our industry, agriculture, national defense and science and technology...." The modernization of science and technology is the key to the "four modernizations." If we cannot modernize science and technology, then we will also be unable to realize the modernization of industry, agriculture, and national defense. In order for Communist Party members to complete the general task of the party at the present stage, it is necessary to energetically study science and technology. Just think, if a Communist Party member's words speak of the need to contribute his whole energy to the "four modernizations," but his actions stress many kinds of objective reasons and search for many excuses, and he is unwilling to study science, can he be considered a qualified party member?

The new party constitution is based on the party's goals of struggle, the general task at the present stage, and the changed needs of the work emphasis; it stipulates duties of party members, and adds the new matter of the need of party members to study science; and whether party members can conscientiously perform party duties and study science, is a manifestation of the strength of their party spirit. Communist Party members, regardless whether they are cadres, workers, peasants or other laborers, must all perform their duties from each according to his ability, study scientific and technical know-how related to their own work, life and labor; enthusiastically use advanced science and technology to change backward production methods, improve their productive forces, and use scientific management methods to improve their work, suited to the needs of modernization and construction. Only in this way can they develop their exemplary vanguard roles in production.

12267
CSO: 4008/136

POPULAR SCIENCE ASSOCIATIONS FLOURISH

OW022149 Beijing XINHUA in English 1554 GMT 2 Mar 84

[Text] Beijing, 2 Mar (XINHUA)--Popular science associations in people's communes or townships have increased from 15,000 to 28,000 in the past year. They have two million members.

This was revealed here today by Yang Xiandong, vice-president of the China Association for Science and Technology. He was addressing the opening ceremony of a national conference on popular science work in the countryside.

Yang Xiandong said that these grassroots associations are playing an important role in training peasant technicians and helping the rural economy develop.

Some of the grassroots associations have set up study groups and technical service centers on specific subjects. These include techniques of growing rice, wheat, onions, garlic and oranges and breeding chickens and fish. There are now about 13,500 such groups or centers in the country. In addition, 11,700 peasants' technical schools have been opened and have an enrollment of 980,000.

The popular science associations also have reading rooms and publish popular science literature. Total circulation of popular science papers in the rural areas has surpassed 30 million.

Xiaxihao township in the suburbs of Yumen, Gansu Province, is a typical example. It has eight villages with 793 households and a population of 9,022. They farm 1,900 hectares of land. The township's popular science association was set up in April last year. The 184 association members include 12 with college-level education, 122 farming, sideline or industrial production technicians, 5 craftsmen and 30 cadres.

Besides popularizing science through radio programs, lectures, short and seasonal training classes, reading rooms, wall papers and booklets, members of the township association also set an example by using scientific farming techniques such as selecting fine seed strains, close planting, rational application of fertilizer and using plastic film to cover corn and vegetable plots.

Gao Xiangguang of Hedong village under the township experienced with growing wheat on one hectare of land he contracted to cultivate last year. He used advanced techniques and harvested more than 7.5 tons of wheat. Many other peasants followed suit and reaped an average of 7 tons of wheat per hectare, almost double the usual output.

With the growth of mass popular science activities, Xiaxihao township is developing agriculture, forestry, animal husbandry and sideline production in an all-round way. Grain output in 1983 was 5.8 percent more than in 1982 and average per-capita income went up 19.1 percent, reaching 550 yuan.

CSO: 4010/64

DEMOCRATIC LEAGUE SPONSORS SCIENCE LECTURES

OW282123 Beijing XINHUA in English 1149 GMT 28 Feb 84

[Text] Beijing, 28 Feb (XINHUA)--A noted scientist stressed here today the development of China's new science and technology in line with the current world technological revolution.

This was stated by Qian Weichang, president of the Shanghai Engineering University and president of the Society for Chinese Language Data Research, at the opening ceremony of a course of lectures on modern science and technology sponsored by the China Democratic League, of which he is also vice-chairman.

He said that the lectures aimed at spreading modern scientific and technological knowledge among the people. The league will also continue to investigate and make suggestions to the government on problems in China's scientific and technological development and personnel training, he added.

Over 1,000 scientists, technicians and teachers attended the first lecture given in the capital this afternoon by Tan Jiazhen, vice-chairman of the Central Committee of the league and professor of Fudan University in Shanghai, on "Genetic Engineering and the World Technological Revolution."

The course includes 10 lectures, one each week. All the lecturers are members of the league.

The lectures to be given include: "Physics in the Life Sciences" by Ma Dayou, deputy director of the post-graduate college of the Chinese University of Science and Technology; "Information Systems and Systematic Science" by Chang Jiong, professor of Qinghua University; "Prospects for Energy Technology" by Zhu Yajie, vice president of the East China Petroleum Institute; "Optical Fibre" by He Peida, president of the Beijing Post and Telecommunications Institute; "Chinese Language Information Processing" by Qian Weichang; and "The Use of Micro Computers" by Chen Tong, deputy director of the Institute of Acoustics of the Chinese Academy of Sciences.

The China Democratic League, mainly composed of intellectuals in cultural and educational circles, has a large group of experts in the natural and social sciences. It sponsored its first course of lectures on various subjects last year.

In addition, local organizations of the league have set up 200 spare-time and correspondence schools and various training courses with 80,000 students since 1981.

The communist party encourages all social forces to help the government train persons of ability.

CSO: 4010/64

LIANG LINGGUANG AT LECTURE ON NEW TECHNOLOGY

HK261143 Guangzhou Guangdong Provincial Service in Mandarin 1100 GMT 24 Mar 84

[Text] Lectures, sponsored by the provincial government, have been given on the new technological revolution, with the last topic being delivered in the provincial science building today: the new technological revolution and marine exploitation. The lecture was given By Comrade (Chen Qingqiao), deputy director of the institute of South China Sea oceanography under the Chinese Academy of Sciences. Governor Liang Lingguang presided over today's lecture and spoke.

These lectures began on 18 February, and have been given on five special topics up to the present, today's lecture being the last in the series. Importance has been attached to these lectures by various sectors. The leading comrades of the provincial government and the relevant departments and units under the provincial authorities actively attended the lectures on separate occasions, which was of great significance to the enhancement of understanding of the leading comrades regarding the new situation in the technological revolution and its importance. At the same time, the lectures enabled the leading comrades to have a basic understanding of the main content of the new technological revolution, and to increase their knowledge about it. This will play a beneficial role in promoting the development of the new technological revolution in our province.

Governor Liang Lingguang pointed out in his speech: These lectures organized by the provincial government are but a beginning. Various departments directly under the jurisdiction of the provincial authorities should, in accordance with the concrete conditions of their own units, continue to organize the cadres and technical personnel to conscientiously study the new technological knowledge, so as to help the broad masses to raise the level of science and technology and be in a better position to accept the challenge of the world's new technological revolution. At the same time, various departments directly under the jurisdiction of the provincial authcrities should proceed from the practical conditions of each unit and carry out investigations and studies, face the world and the future, make forecasts, and put forward plans to cope with the chellenge of the new technological revolution. At present, it is necessary to grasp firmly the popularization and application of microcomputers, so as to speed up the technological progress of our province and to enhance economic results.

CSO: 4008/215

SCIENCE ASSOCIATION CONFERENCE PUTS FORTH TASKS

HK300138 Nanning Guangxi Regional Service in Mandarin 1130 GMT 27 Mar 84

[Excerpts] The work conference of regional science and technology associations put forth the key task for science and technology associations in 1984, namely, to give full play to the role of mass bodies for science and technology, unite and mobilize the vast number of scientific and technological workers, conscientiously implement the principle of science and technology serving economic development, vogorously carry out academic exchanges, and popularize science and technology, thus making contributions toward achieving the goal of raising our region's economy to a level above the intermediate level of the nation by the end of this century.

The work conference was held in Nanning from 22 to 26 March. Hou Depeng, member of the regional CPC committee standing committee; Ye Fusun, chairman of the regional association for science and technology, and others spoke at the conference.

The conference pointed out that in order to enable science and technology to more satisfactorily serve economic construction, the science and technology associations at all levels in our region must emancipate their minds, rely on their own strength, chart their own paths and soundly grasp the following aspects of their work:

1. They should vigorously develop academic activities.

2. They should intensify their efforts in popularizing science in order to raise the scientific and technological level of the masses of the people, popularize applicable science and technology, and thus serve the development of our national economy.

3. They should satisfactorily grasp the work of providing scientific and technological advisory service.

4. All the associations, learned societies, and research societies should hold, in light of the actual conditions and needs of our scientific and technological workers, scientific and technological training courses and lectures, organize academic exchanges, and adopt various other methods to help them improve their professional competence.

5. The science and technology associations at all levels and the learned and research societies under them should conscientiously take the initiative in helping party committees implement the party's policies toward intellectuals.

CSO: 4008/215

GUANGDONG SCIENCE, TECHNOLOGY MEETING ENDS

HK260133 Guangzhou Guangdong Provincial Service in Mandarin 0400 GMT 25 Mar 84

[Text] The Guangdong provincial science and technology work conference concluded today after 6 days in session. At the final session this morning, Vice Governor Wang Pingshan delivered a summation on behalf of the provincial CPC committee and government. In accordance with the spirit of the provincial CPC committee's and government's discussions on science and technology work, Comrade Wang Pingshan spoke on five specific points in strengthening leadership over science and technology work:

1. The provincial CPC committee is establishing a science and technology leadership group, in order to make concentrated use of the science and technology force of all sectors, study the new world technological revolution and look into our counterstrategy, formulate medium- and long-term plans for science and technology in the province, study and draw up major technology policies and science and technology projects, and coordinate the science and technology work of all departments.

2. Strengthen and perfect the provincial science and technology management setup. Science and technology committees have now been set up in all cities, prefectures, and counties in the province. In accordance with the provincial CPC committee's decisions, districts [qu] should appoint science and technology assistants, and departments in charge of the economy, together with enterprises, should set up science and technology offices and sections.

3. Develop more ways of raising science and technology funds. The provincial government has initially decided to take 0.5 to 1 percent of income from sales of new products for use as funds in developing technological transformation and new products.

4. Perfect the policies for encouraging technological progress. The provincial agricultural bank has decided that in the future science and technology must be regarded as one of the focal points for agricultural loans. The departments concerned should institute tax and pricing policies that encourage technological progress. It is necessary to reward people who have made creations and inventions and have contributed to stimulating technological progress and the improvement of economic results. We must not indulge in egalitarianism.

5. The party committees and governments at all levels must assign a leading comrade to take charge of science and technology work.

CSO: 4008/215

WANG DAOHAN ANNOUNCES NEW TECHNOLOGY PLAN

OW260724 Beijing XINHUA in English 1852 GMT 25 Mar 84

[Text] Shanghai, 25 Mar (XINHUA)--Shanghai Mayor Wang Daohan announced here today a plan to make new breakthroughs in developing new technology this year.

Delivering a government work report to the Shanghai People's Congress, he said Shanghai would concentrate its efforts on seven new technologies including microelectronics, new materials, optical fiber communications, lasers, biological engineering, robots and marine engineering.

The mayor said the city will make a breakthrough in microelectronic technology to speed up the establishment and development of new industries in face of the world's new technological revolution.

Shanghai, the largest industrial base in China, has more than 600 scientific research institutes, 51 regular higher education establishments and 280,000 scientists and technicians.

The mayor disclosed that concentrated efforts in the next two years will be devoted to the development of 230 types of integrated circuits, including 30 large scale ones.

A microelectronic industrial area will be set up in the southwest suburbs of the city with least polluted environment and fine quality water resources.

Shanghai's five new technology bases, under construction or to be built, will promote the development of computer software, biological engineering, new materials, laser technology and optical fiber communications.

CSO: 4010/71

HENAN SCIENTIFIC, TECHNOLOGICAL WORK CONFERENCE

HK250826 Zhengzhou Henan Provincial Service in Mandarin 1030 GMT 24 Jan 84

[Summary] The Henan provincial conference on scientific and technological work concluded on 20 January. The conference pointed out: "Penetratingly implementing the central authorities' strategic principle on scientific and technological development, further gearing scientific and technological work to the needs of economic construction, and endeavoring to create a new situation in our province's scientific and technological work is the guiding ideology and objective of struggle of our province's 1984 scientific and technological work."

The conference formulated the main tasks of our province's 1984 scientific and technological work. The main tasks are to lay stress on quadrupling the annual gross industrial and agricultural output value by the end of this century and to start the study and working out of our province's long-term plan for scientific and technological development. It is necessary to concentrate our forces on tackling key scientific problems. It is essential to popularize advanced technology and scientific and technological achievements which are urgently needed in production. After carrying out pilot projects, we must put forward proposals on readjusting and consolidating all scientific research organs throughout the province and must put these proposals into effect. We also must continue to implement the party's policy on intellectuals and must strengthen the management of scientific and technological cadres so as to further arouse scientific and technological workers' enthusiasm.

The conference emphasized that to complete the above-mentioned tasks, it is imperative to take effective measures to further heighten leading comrades, cadres; and the masses' understanding of the important role of science and technology in socialist modernization. "Cadres in scientific and technological management departments at all levels must diligently study professional knowledge, the knowledge of modern management, and economic knowledge and must raise their management level. Science and technology committees at all levels must strengthen unified management and supervision of scientific and technological work in all walks of life and trades, must give full play to their role as a management department, and must serve as advisers to CPC committees and the government in the aspect of science and technology."

CSO: 4008/188

SCIENTIFIC ADVISORY GROUP ESTABLISHED

Chengdu SICHUAN RIBAO in Chinese 2 Dec 83 p 1

[Article by Feng Benchao [7458 2609 6389]: "Provincial Science and Technology Advisory Group for Military Technology Established"]

[Text] In order to improve the organization of the scientific and technological strength of the defense industry in our province, to give full play to the role of specialists and scholars, and to serve our national defense and the national economy, the establishment in the last week of October of a provincial leading group for military technology was followed on 22 November by the establishment at Chengdu of a Provincial Science and Technology Advisory Group for Military Technology.

Sixty-four persons were invited to join the Advisory Group. Among them were scientists and technicians of the older generation who have had ample practical experience or have made outstanding accomplishments, also scientific, technical and managerial personnel of post-liberation vintage, who have a certain scholarly standing or have shown creative achievements in technical fields. Among the appointees, research fellows, senior engineers and economists account for 55 percent of the total number of the group. The main tasks of the Advisory Group will be: to formulate long-term developmental plans for science and technology in the defense industry of our province and to formulate important science and technology policies; to investigate and make suggestions on major science and technology topics which have overall comprehensive and long-term significance; to launch scientific research, trial-manufacture and production of key military articles; to organize coordination to tackle key technical problems, draw up plans for technical transformation and measures for acquisition of technology from abroad and to submit opinions and suggestions; to develop major civilian goods and economic and technical cooperation between civilian and military sectors, the transfer of military industrial technology, and engage in techno-economic debates; to apply modern scientific achievements, conduct research and provide guidance on administrative and management issues and work to improve the quality of enterprises and research institutes, and raise economic results; to launch investigations and research on the problems of intellectual development and of educating and training staff and workers, and to submit opinions and suggestions on developmental plans and measures in this respect. They will maintain close relations with all military and industrial societies and advisory organizations,

organize scientific and technological information exchanges, transfer successful achievements and technical services, train talents, etc. between military factories and between military and civilian industry. They shall accept research and consultative assignments from provincial offices and bureaus, from any civilian enterprise, research institute or college.

Provincial Vice Governor Kang Zhenhuang [1660 2182 7806] attended the inaugural meeting.

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CSO: 4008/123

SCIENTIFIC AND TECHNICAL ADVISORY CENTER FORMED IN SICHUAN

Chengdu SICHUAN RIBAO in Chinese 4 Sep 83 p 1

[Report by Zhao Jian [6392 1017]: Sichuan Establishes Scientific and Technical Advisory Center"]

[Text] Our provincial scientific and technical advisory center was formally established yesterday with Vice Governor Kang Zhenhuang [1660 2182 7806] as its director.

As early as 1981 the Scientific and Technical Advisory Corporation was formed in our province and had extensively promoted activities in scientific and technical consultation in order to do well in counseling party and government leaders at all levels and to promptly turn science and technology into productive forces. According to the figures of 32 advisory organs, last year a total of 1,098 projects were accepted which had solved problems for economic construction units and had achieved tangible economic results. The center's advisory department for the technical application of petroleum products had solved the urgent need for oil in production for 267 units of the Linjiang Machine Tool Plant, the Chengdu No 2 Plastic Plant and the Chengdu Science and Technical College, creating about 150,000 yuan in economic value for the state. The provincial scientific association organized the provincial crop association and the cotton specialty committee together with specialists of soil, plant protection, meteorological and pedological associations to conduct a full-scale analysis and study of the problem of division and distribution of cotton in our province, which proposed rational division and distribution of cotton, reform of the cropping system for cotton areas and the improvement of variety and cultivation techniques. These were accepted by the province and have changed the state of annual drop in cotton production in our province, increasing the economic benefits of cotton areas by 120 million yuan and grain harvest by 160 million jin. The achievement from this policy consultation has received the third-class award on major scientific and technical achievement of Sichuan.

Numerous facts have shown that the task of scientific and technical consultation greatly benefit social and economic development. In order to further promote activities in scientific and technical consultation, the Scientific and Technical Advisory Corporation has been abolished with the approval of the provincial government and the scientific and technical advisory center formally established.

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CSO: 4008/78

CONFERENCE HELD IN SICHUAN TO DISCUSS TECHNOLOGICAL REFORM

Chengdu SICHUAN RIBAO in Chinese 6 Jun 83 p 1

[Article by Xia Xia [1115 0633]]

[Text] Recently, the provincial government of Sichuan held a province-wide conference to discuss technological reform. Through learning sessions and discussions, the conference accomplished the following tasks: understanding the importance and urgency of technology reform; identifying the direction and key issues of reform; and studying the plans and important technical and economic policies for the last 2 years of the Sixth Five-Year Plan period. The objective of the conference was to facilitate continuing technological reform in this province.

In recent years, considerable progress was made in the technological reform of existing industries in Sichuan. From 1979 to 1982, local industries invested in 16,454 technological reform programs each costing more than 50,000 yuan; the total investment was 2,539.9 million yuan. Generally speaking, encouraging results were obtained; at the end of 1982, 1,698 projects at the provincial level were completed, which was 92 percent of the total number of projects initiated. Through technological reform, a number of light industrial products and raw-material products were developed to meet market demands; significant savings in energy resources were achieved; technological advances were made in some industries; and a number of new products were developed. The conference requested that all local communities and concerned agencies make good use of their experience and industrial foundations to carry out unified and systematic reforms to meet their product goals. In particular, priority should be given to the mechanical and electronic industries in order to provide advanced equipment for other industries. For the near term, emphasis should be placed on the light textile industry to stimulate the development of consumer products; also concerted efforts of technological reform should be made in the metallurgical, chemical, and construction-material industries, as well as in the areas of transportation, architecture, and urban affairs.

During the conference, plans for technological reforms for the last 2 years of the Sixth Five-Year Plan period and the specific programs for this year's reforms were discussed. For next year and the following year, a total of 128 programs of key technological reforms have been scheduled in this

province (not including Chongqing), with a total investment of 508.68 yuan. Upon completion, these programs will have significant impact on the existing industries in this province in terms of new facilities, new construction, and imported technologies and equipment; as a result, the technical and economic conditions will be much improved. After reviewing the current situation in the province, the conference also discussed several policy-related problems such as distinguishing basic development from technological reform; judicious increase of the rate of depreciation; acquisition of funds to carry out technological reform for industries with low or negative profits; accumulation of capitals and obtaining bank loans for existing industries; definite plans and procedures for each topic were established.

Furthermore, the conference discussed and established the "Preliminary Management Policies for Technological Reform for Local Industries in Sichuan Province."

There were more than 200 participants at the conference which included mayors, specialists, governors, accountants, heads of financial committees, bank presidents, and department heads in the provincial government. Speakers at the conference included the vice chairman of the provincial consulting committee Lu Dadong, and deputy governors He Haoju, Jiang Minkuan, and Gu Jinchi.

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CSO: 4008/135

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